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Pawlus et al.

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(54) **FOOTWEAR ARTICLE WITH ADJUSTABLE STIFFNESS**

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(51) **Int. Cl.**
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A43B 23/22 (2006.01)
A43B 1/10 (2006.01)

(52) **U.S. Cl.** .... **36/76 R**; 36/102; 36/30 R; 36/25 R

(58) **Field of Classification Search** .... 36/76 R, 36/102, 30 R, 25 R

See application file for complete search history.

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(57) **ABSTRACT**

An article of footwear or shoe assembly, which is designed to allow for adjustment of stiffness in its sole unit, is disclosed. The article of footwear is preferably constructed to enhance stability, support and comfort of a wearer on varied terrain. Among other elements, the shoe assembly preferably includes an adjustable shank disposed within the shoe to allow for adjustment in the stiffness of the sole unit. In certain embodiments, the adjustable shank further includes a plurality of segments adapted to be manipulated in order to vary the stiffness.

34 Claims, 21 Drawing Sheets

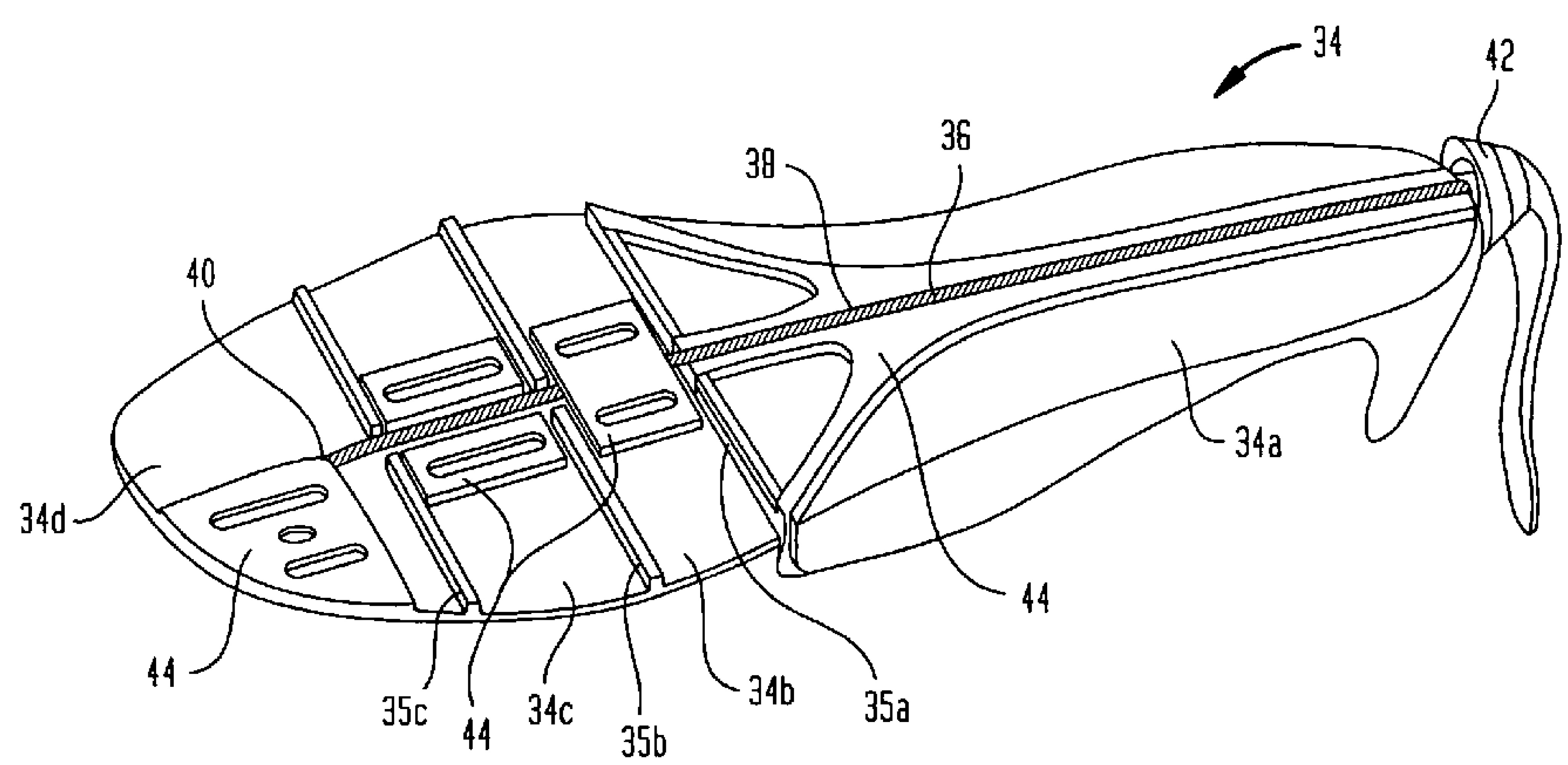

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FIG. 1

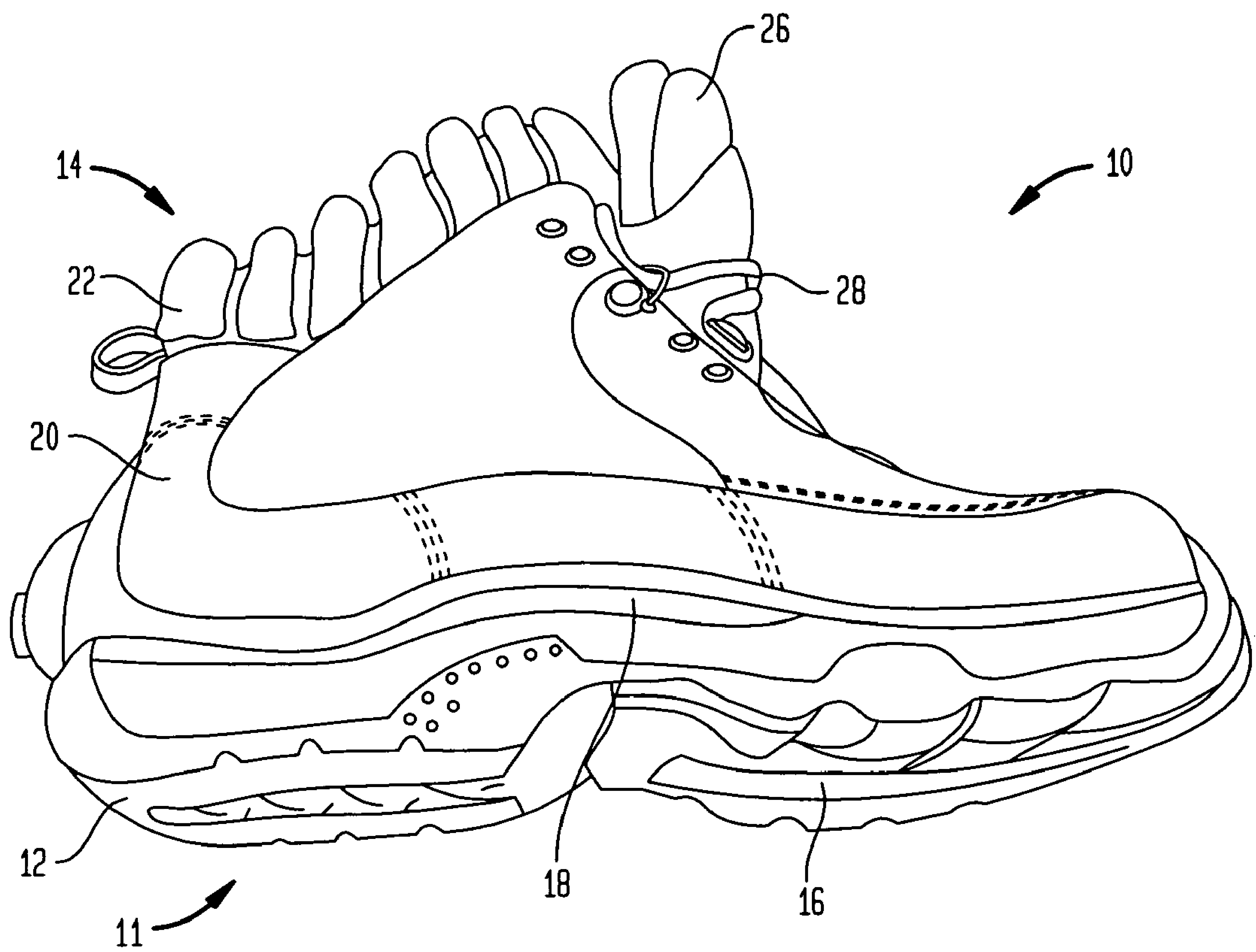
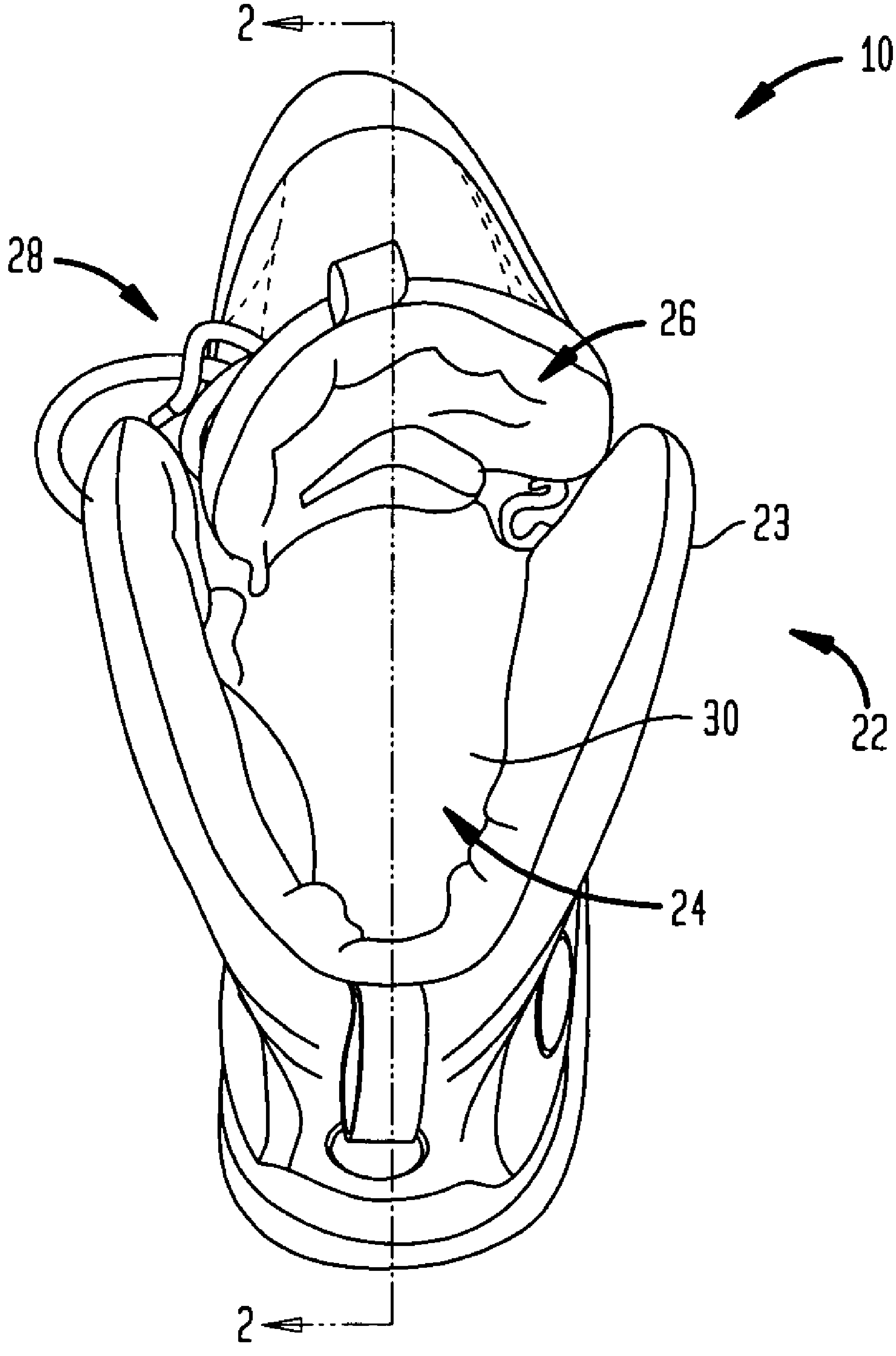


FIG. 2



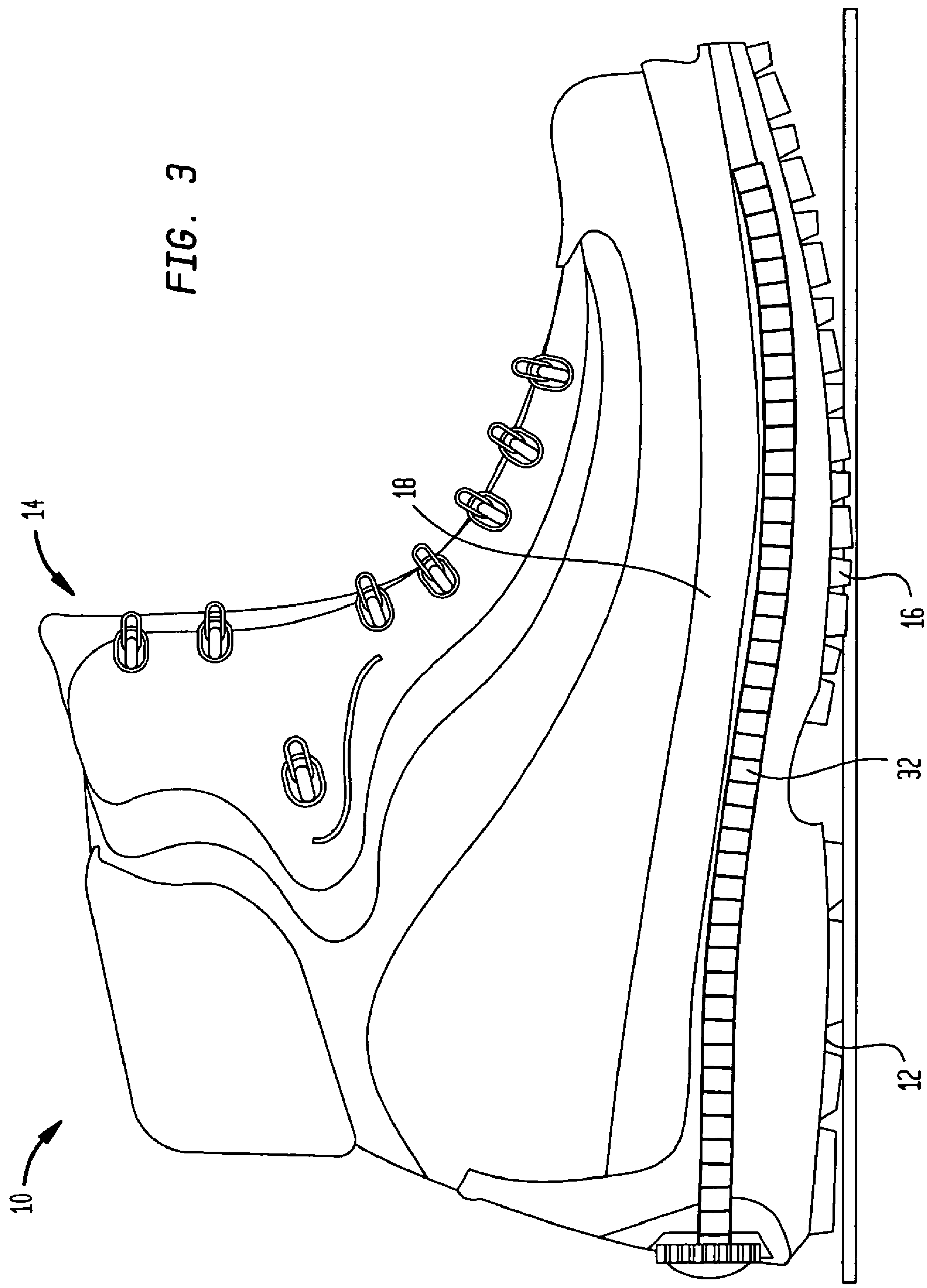


FIG. 3

FIG. 4A

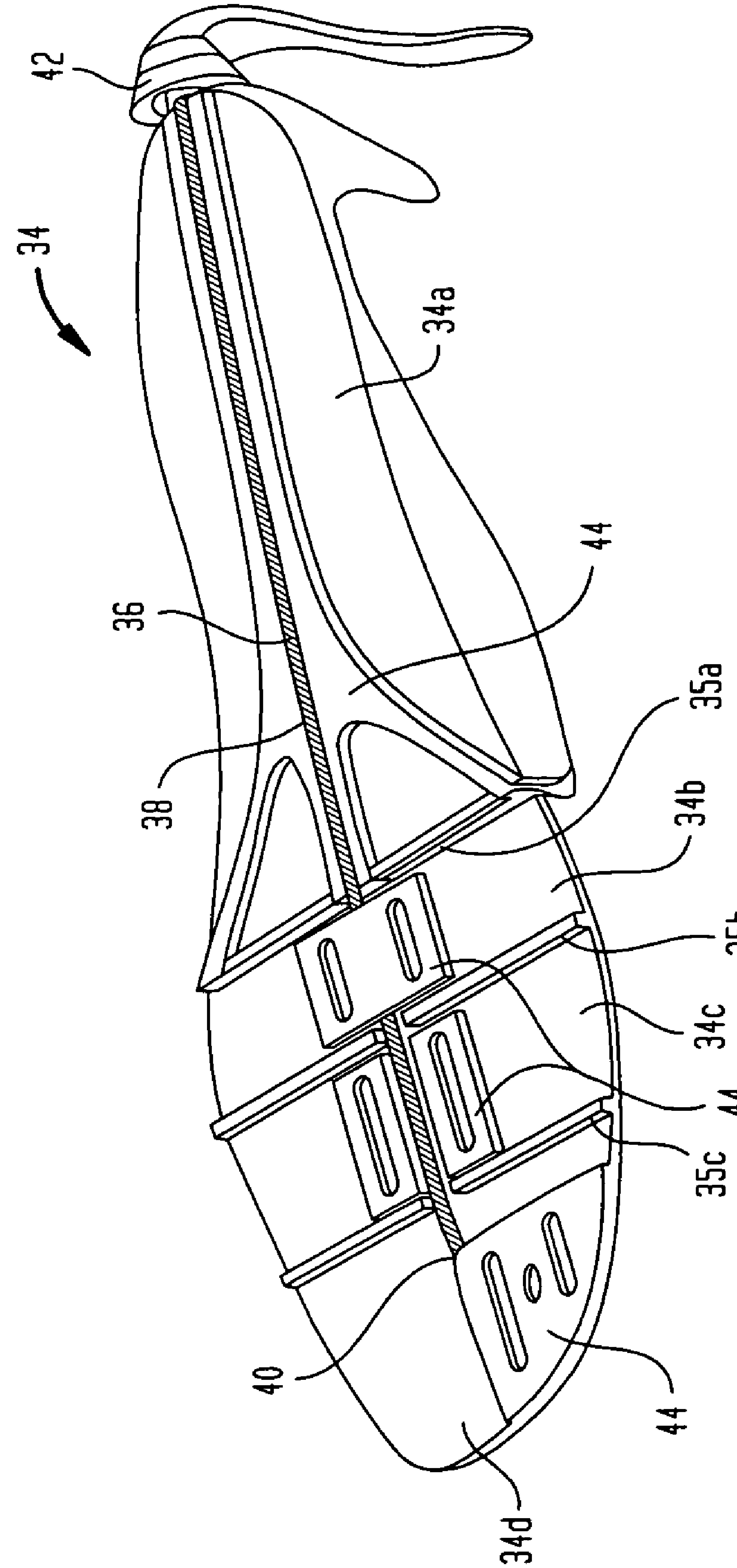
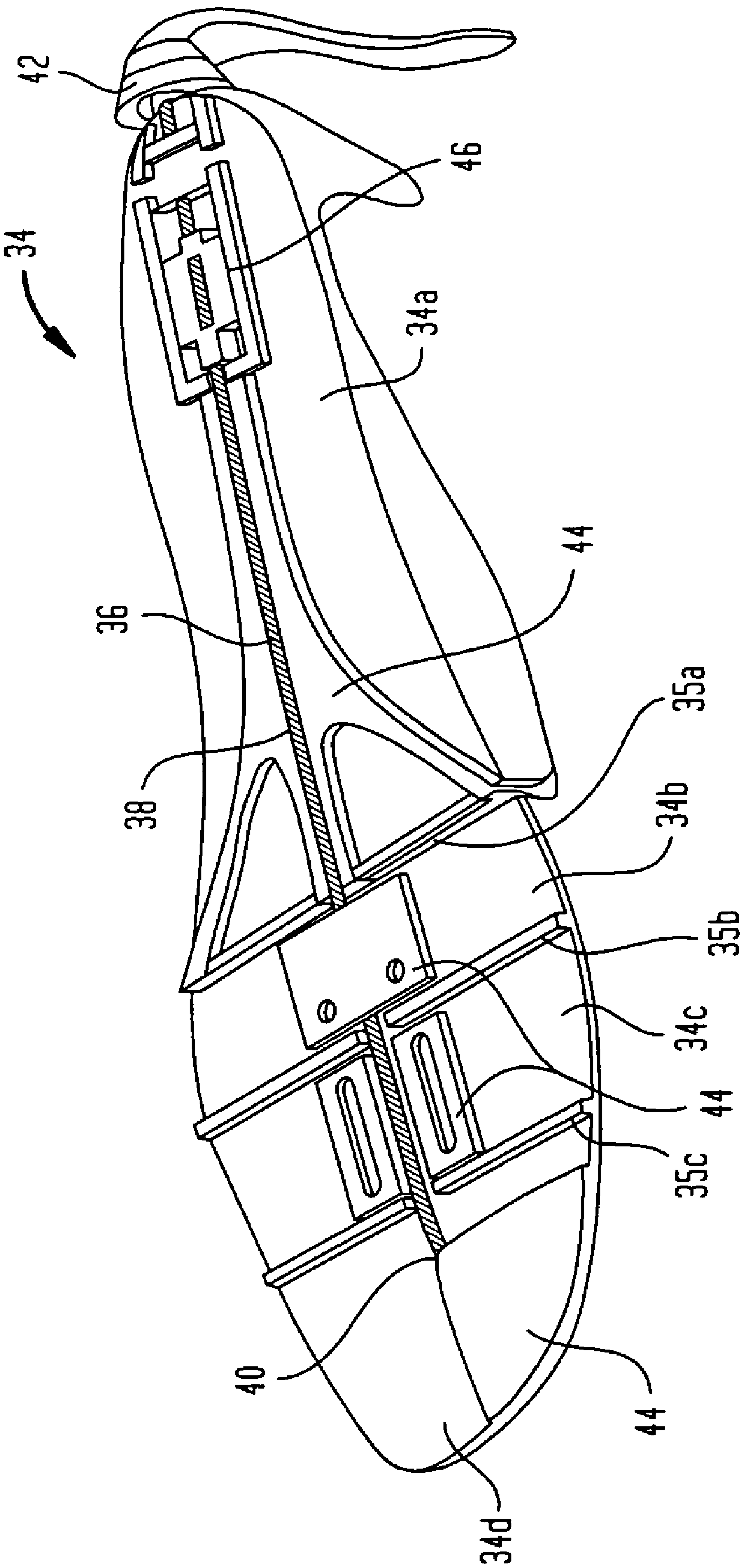


FIG. 4B



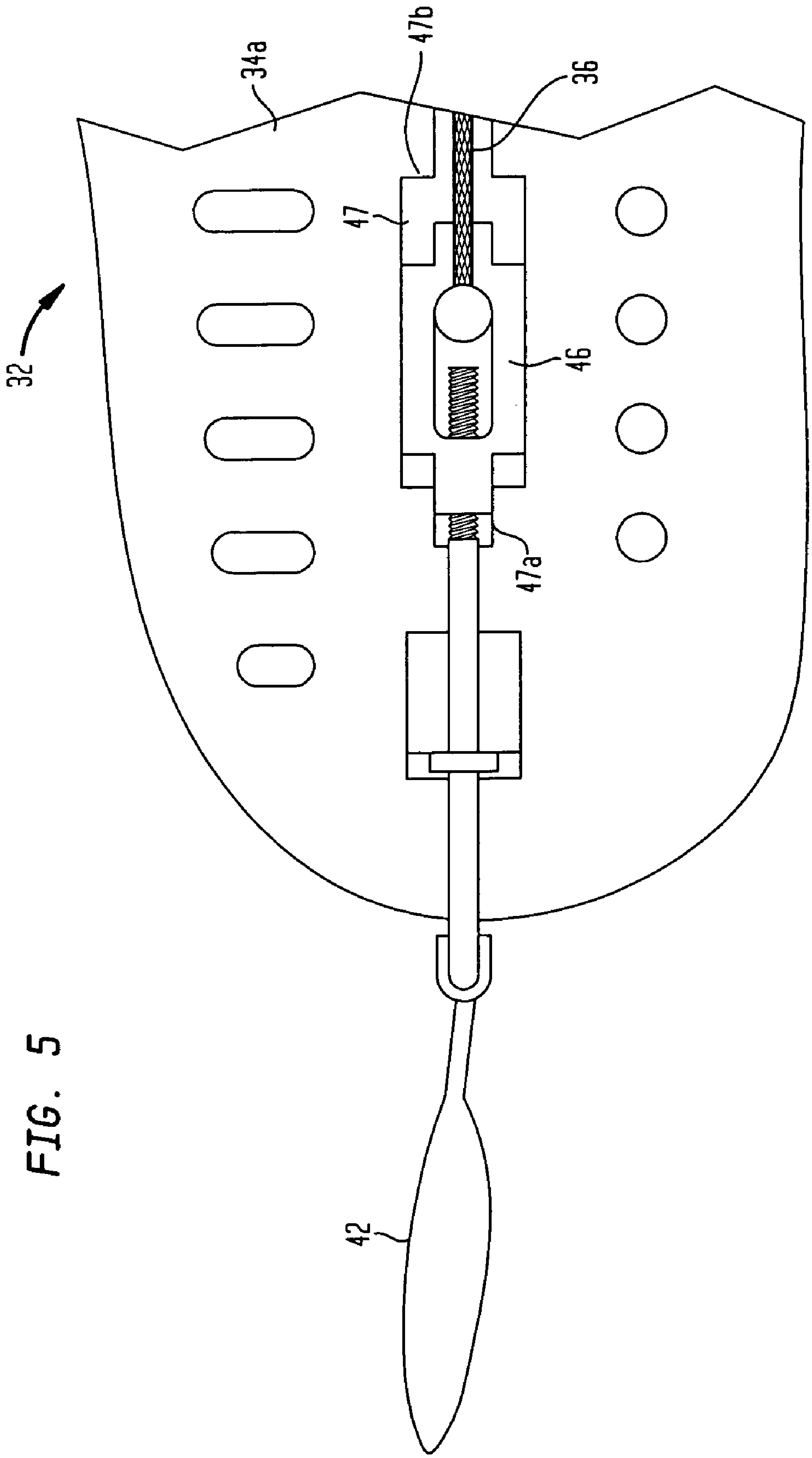
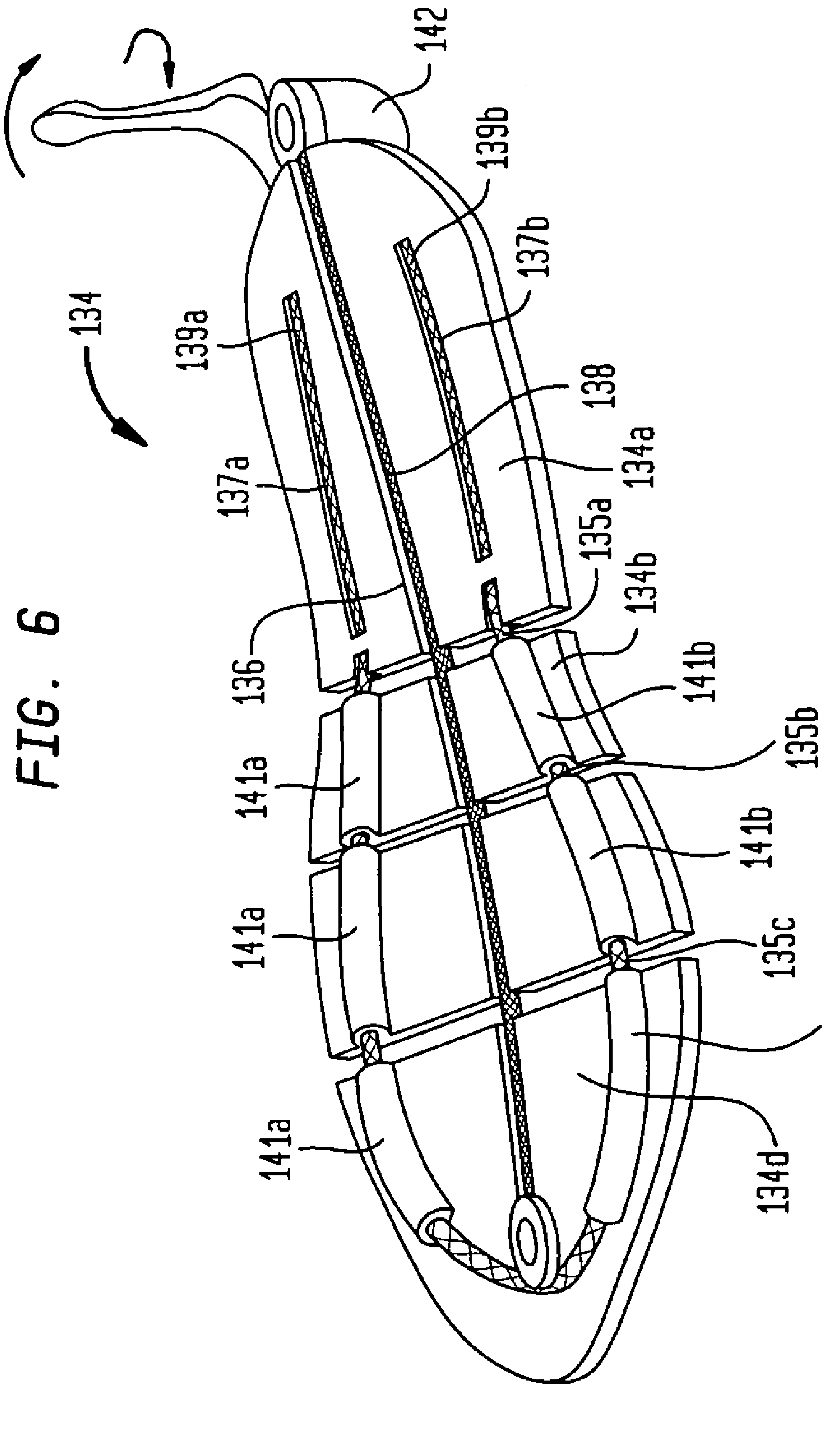


FIG. 5

FIG. 6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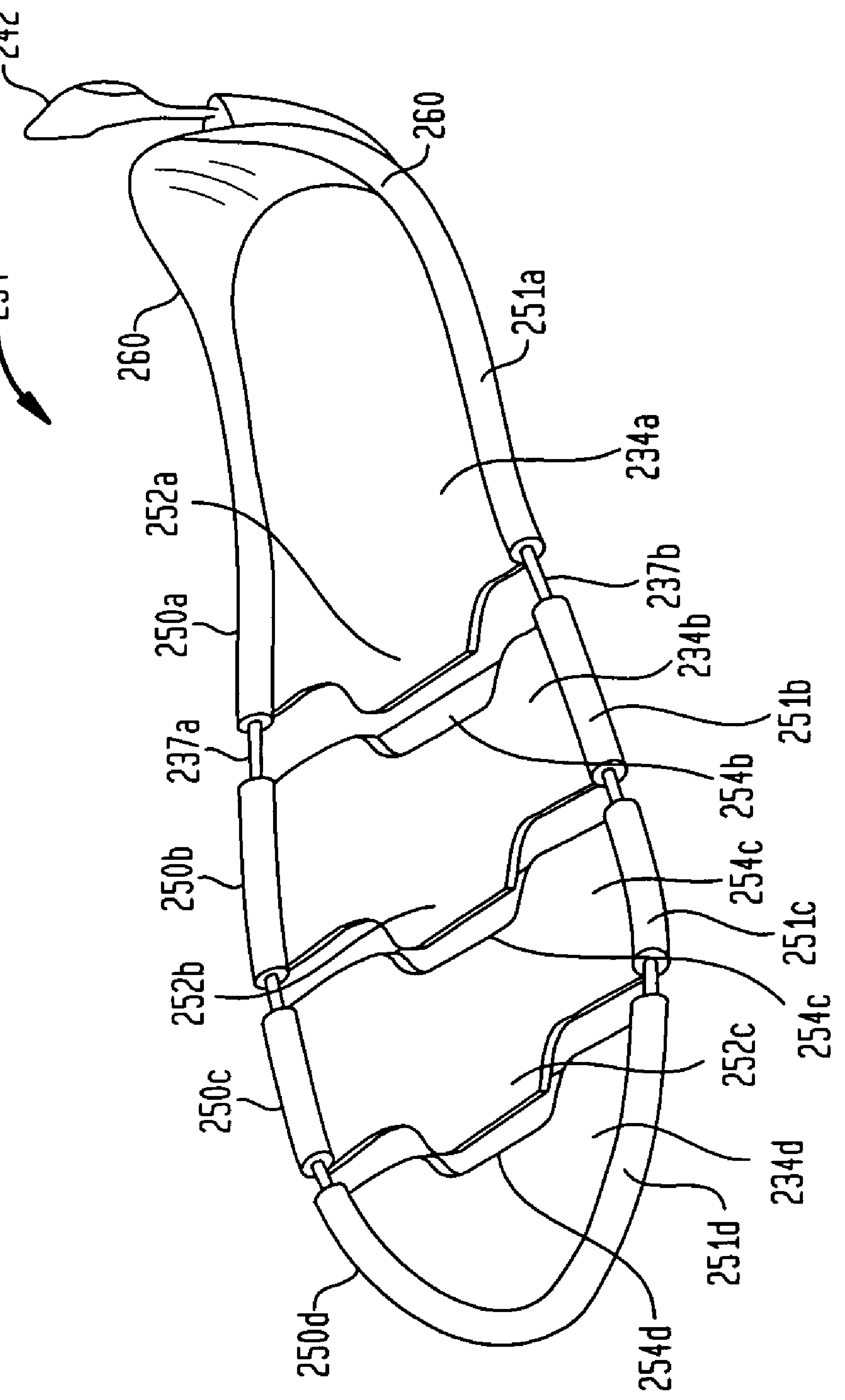
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FIG. 7

FIG. 8A

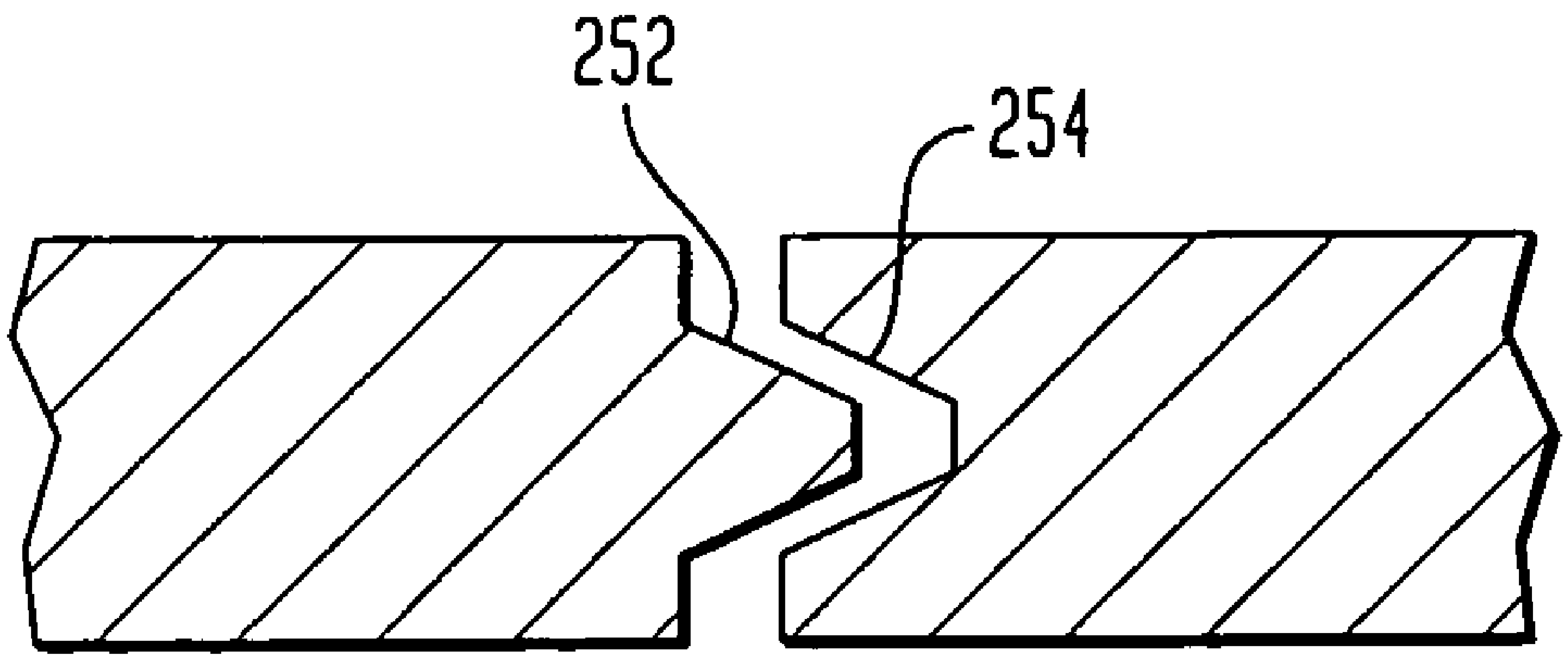


FIG. 8B

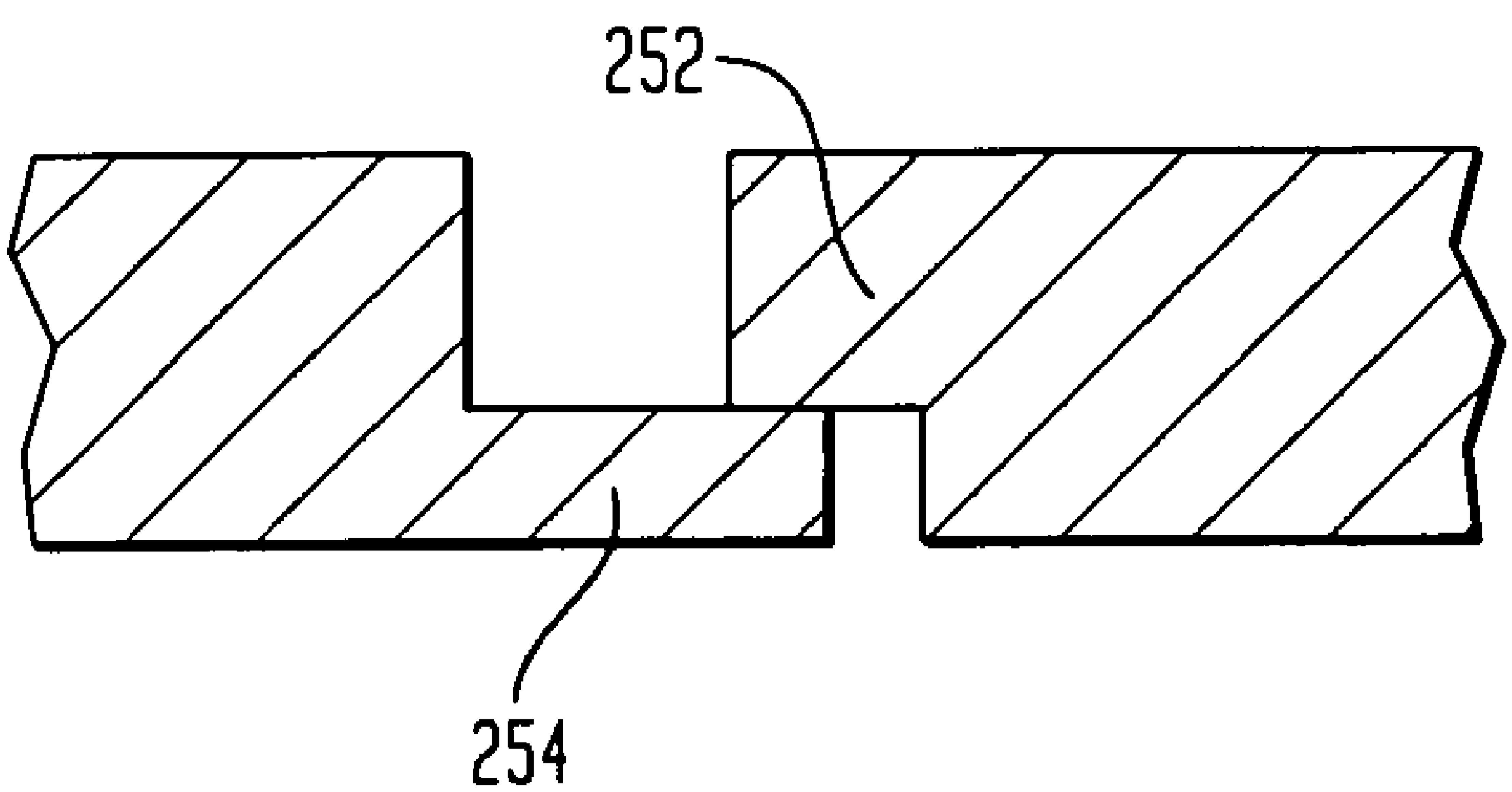
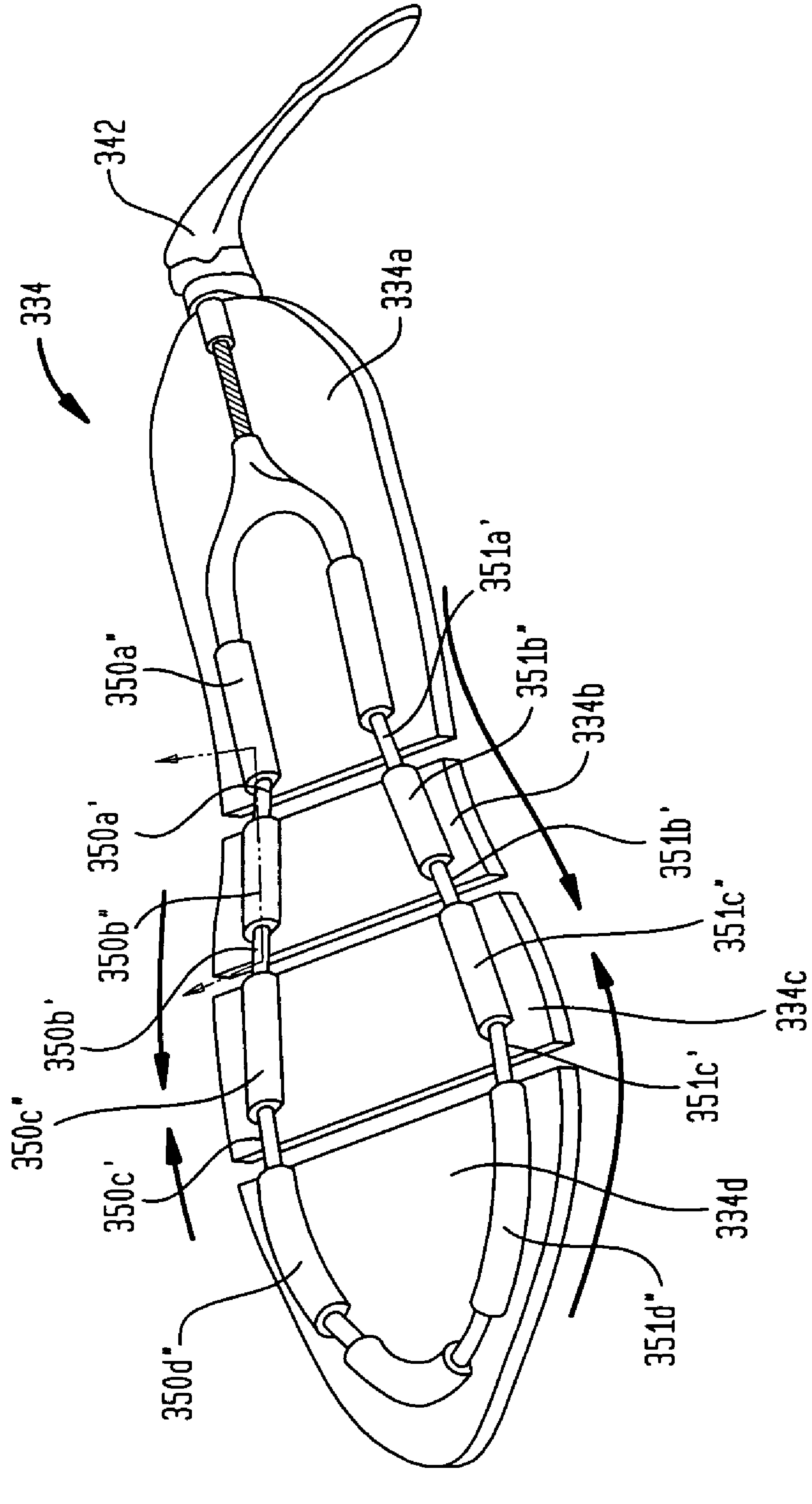


FIG. 9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334
334a
351a'
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334d
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350d"

FIG. 10

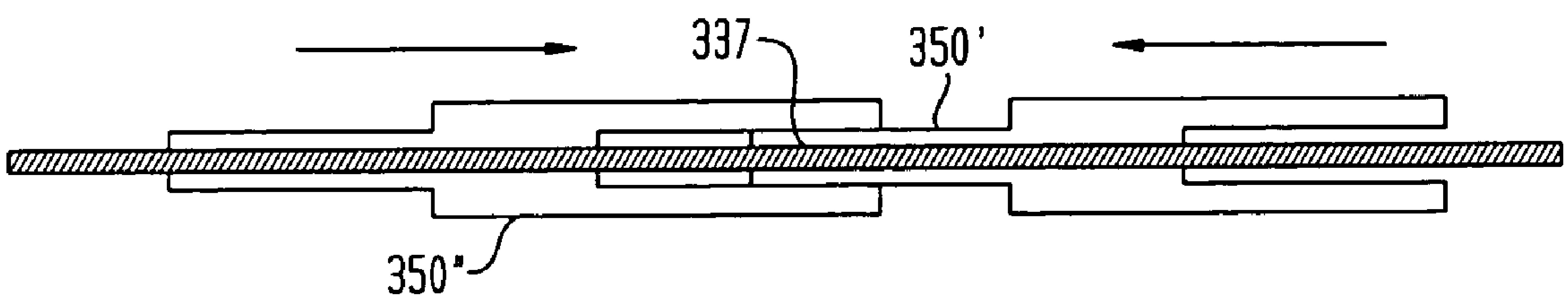
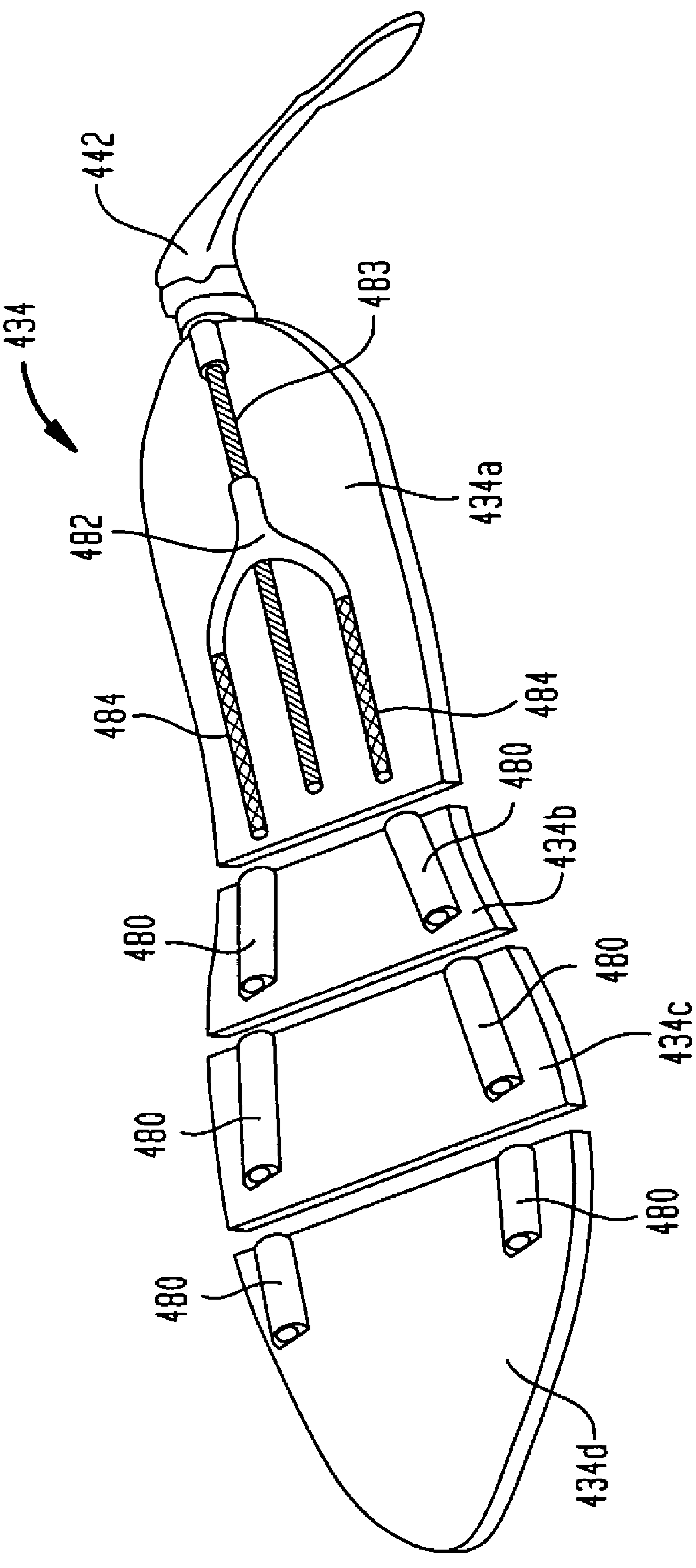


FIG. 11A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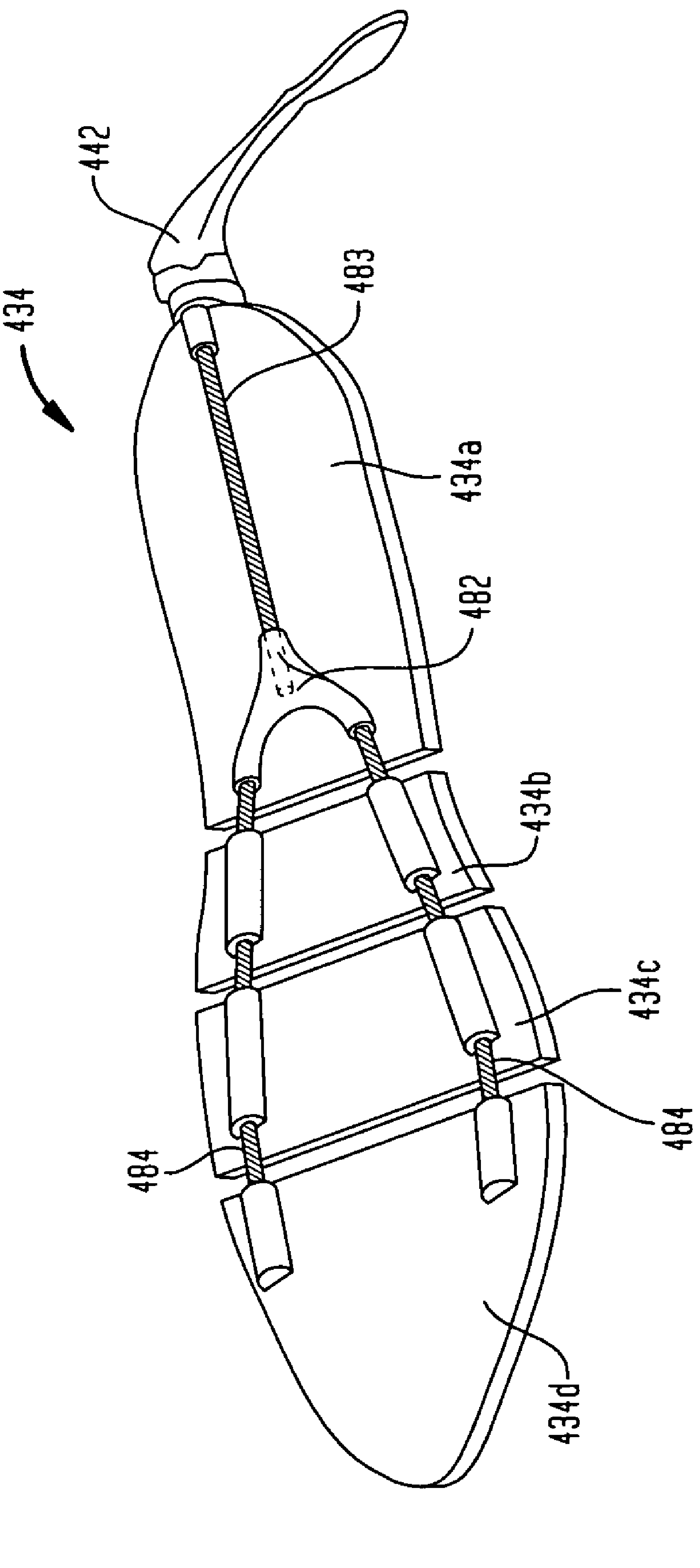

FIG. 11B

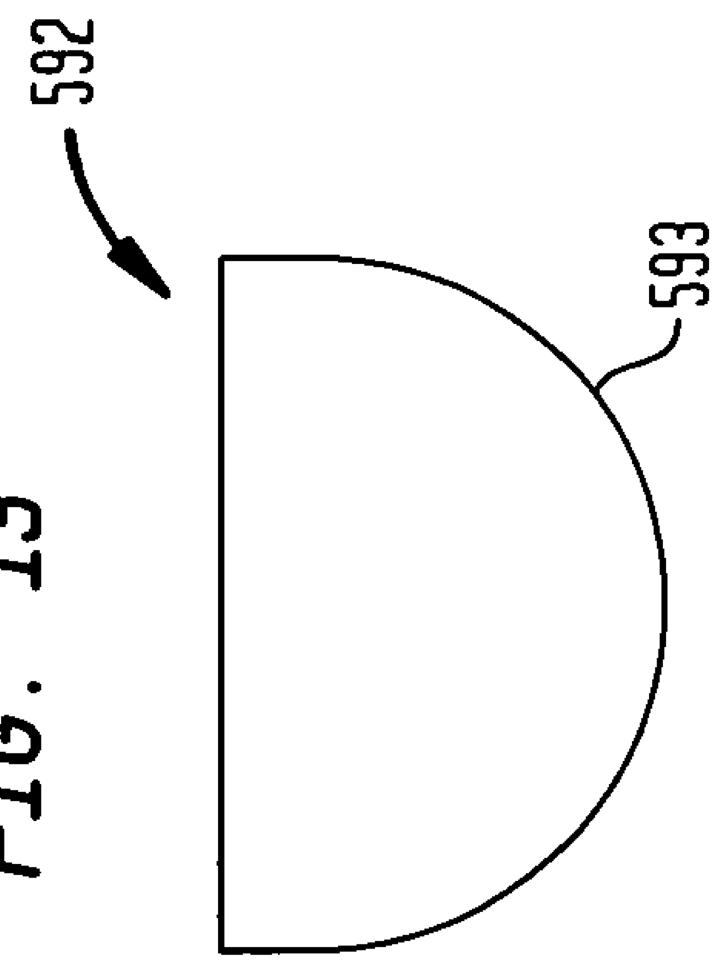
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FIG. 13

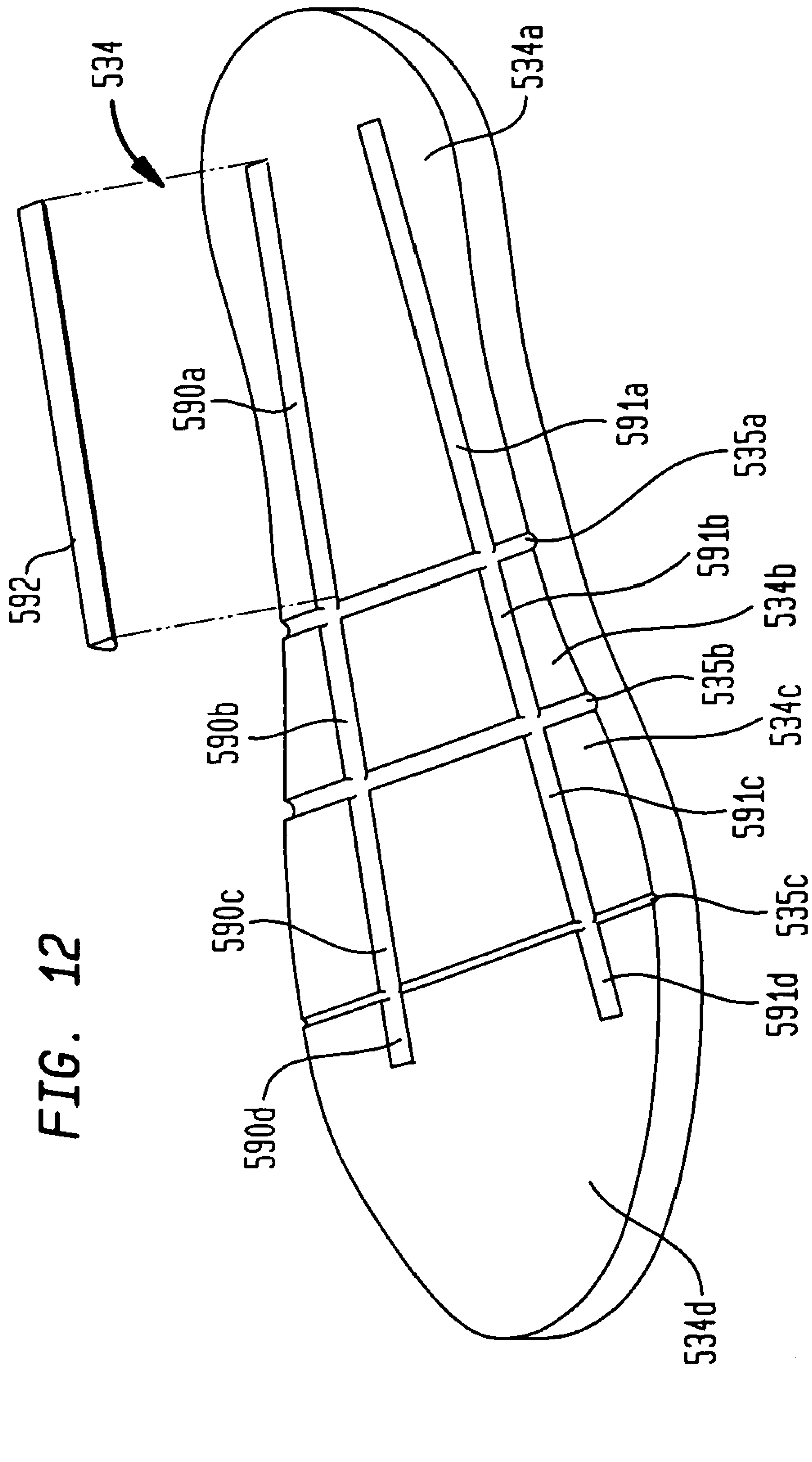
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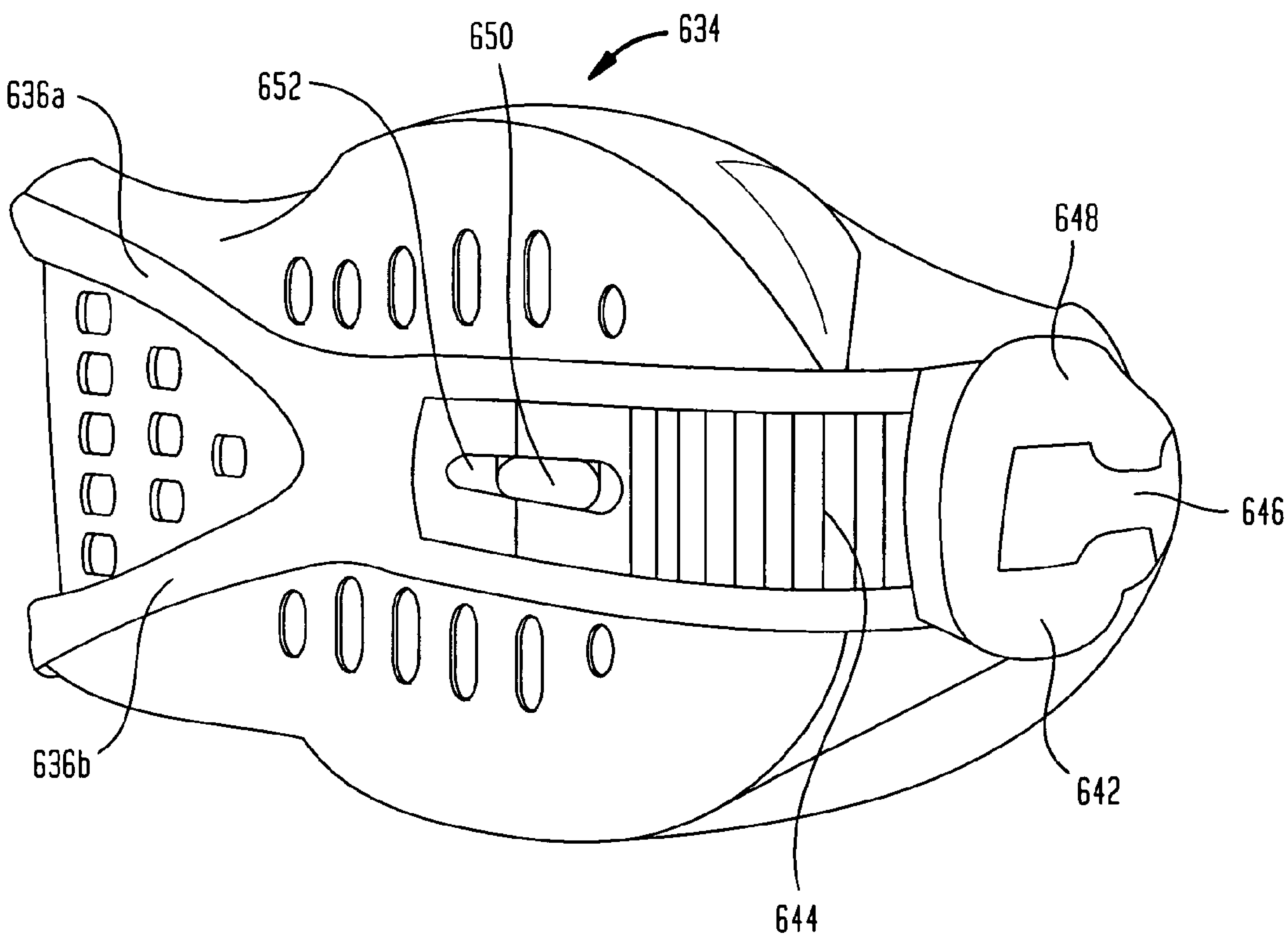
FIG. 12

FIG. 14



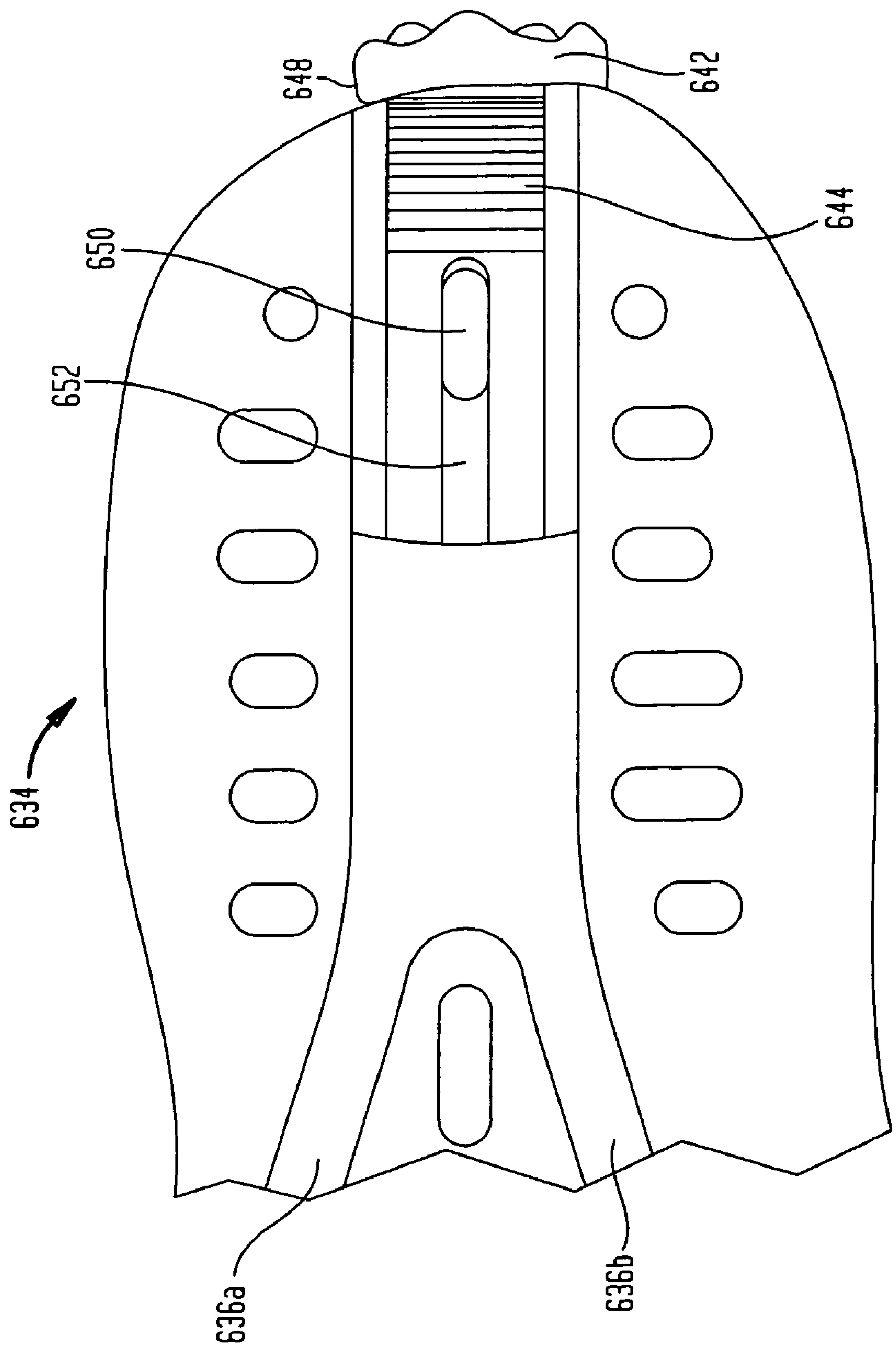


FIG. 15

FIG. 16

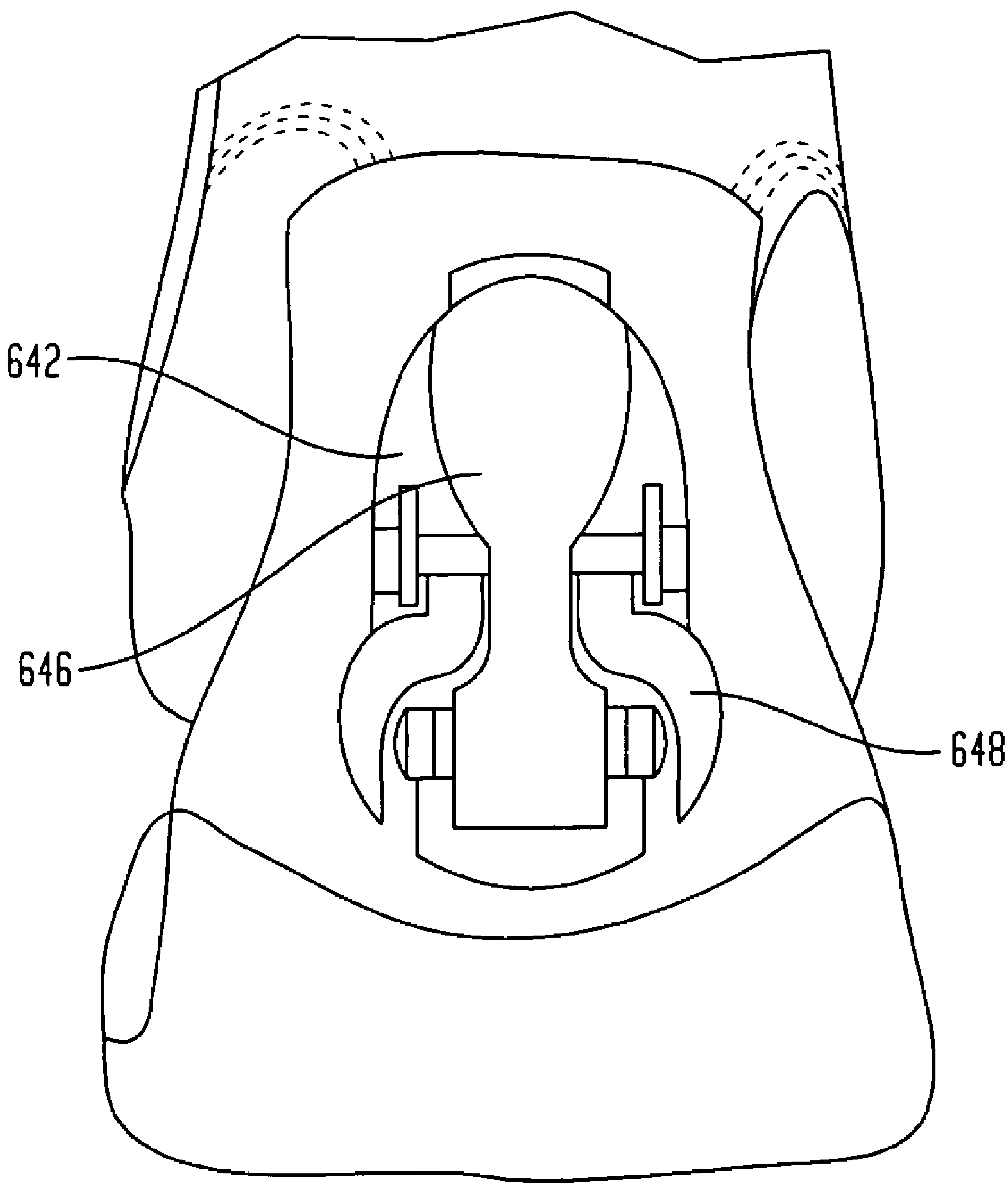
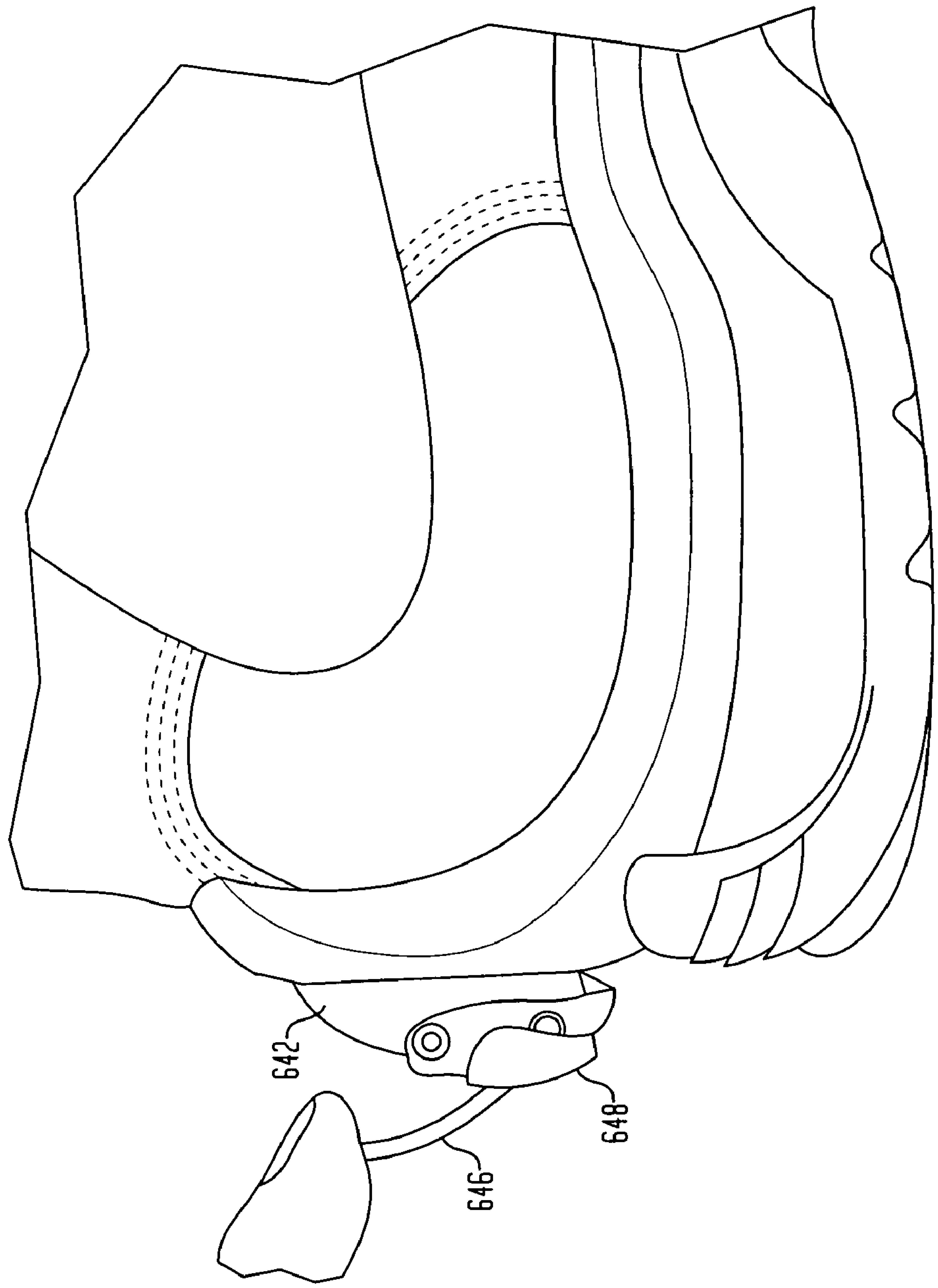


FIG. 17



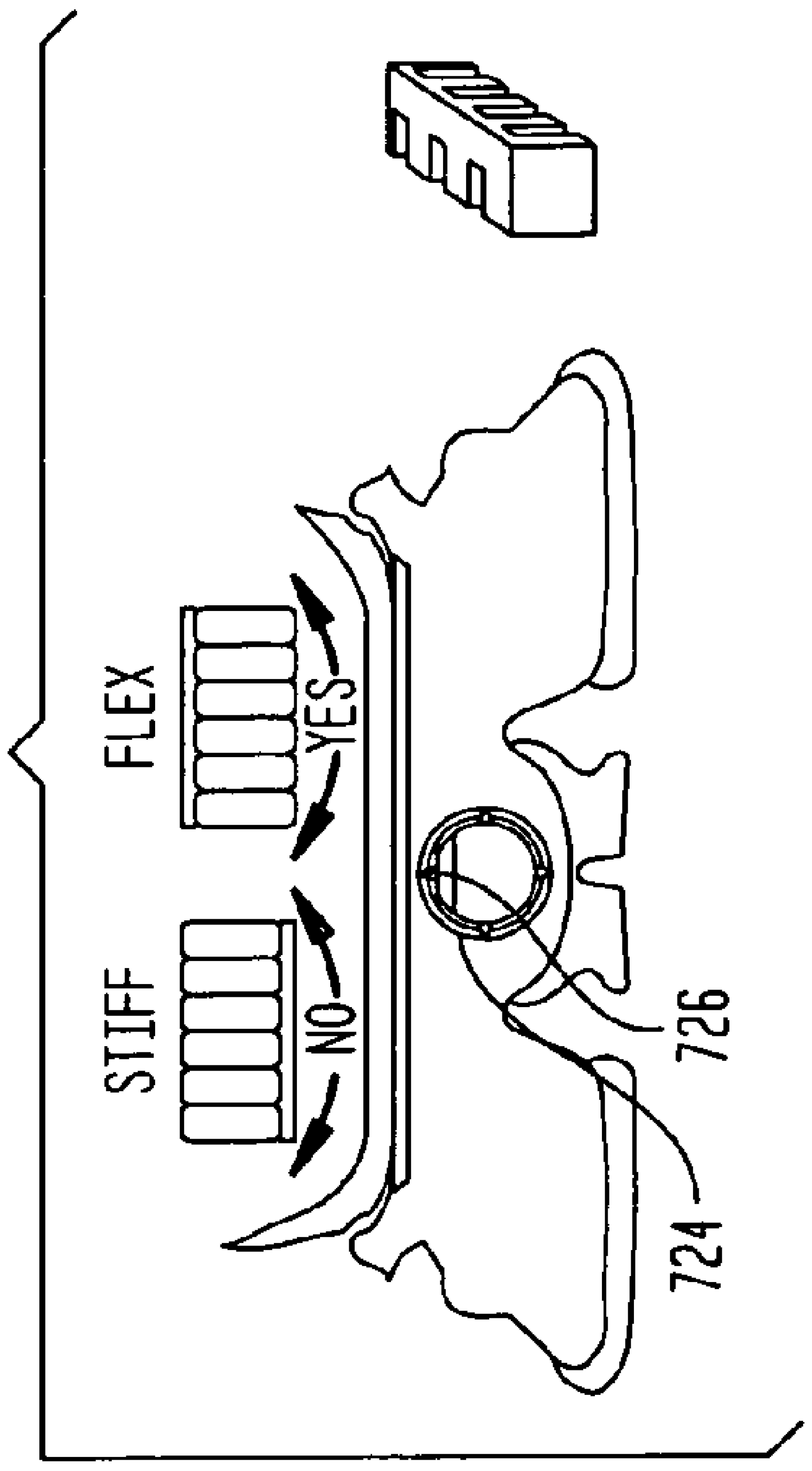


FIG. 19

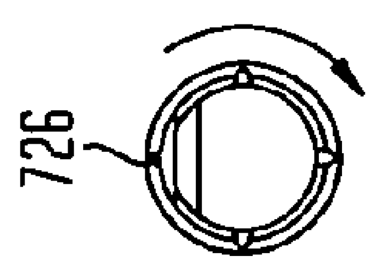


FIG. 20A

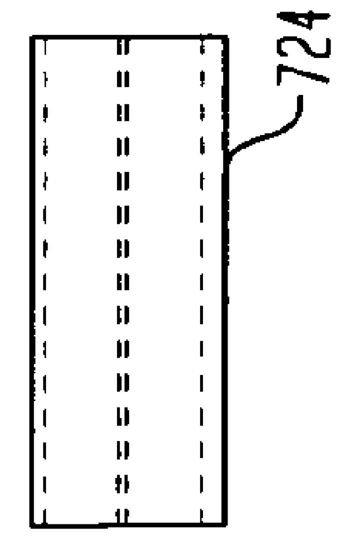


FIG. 20B

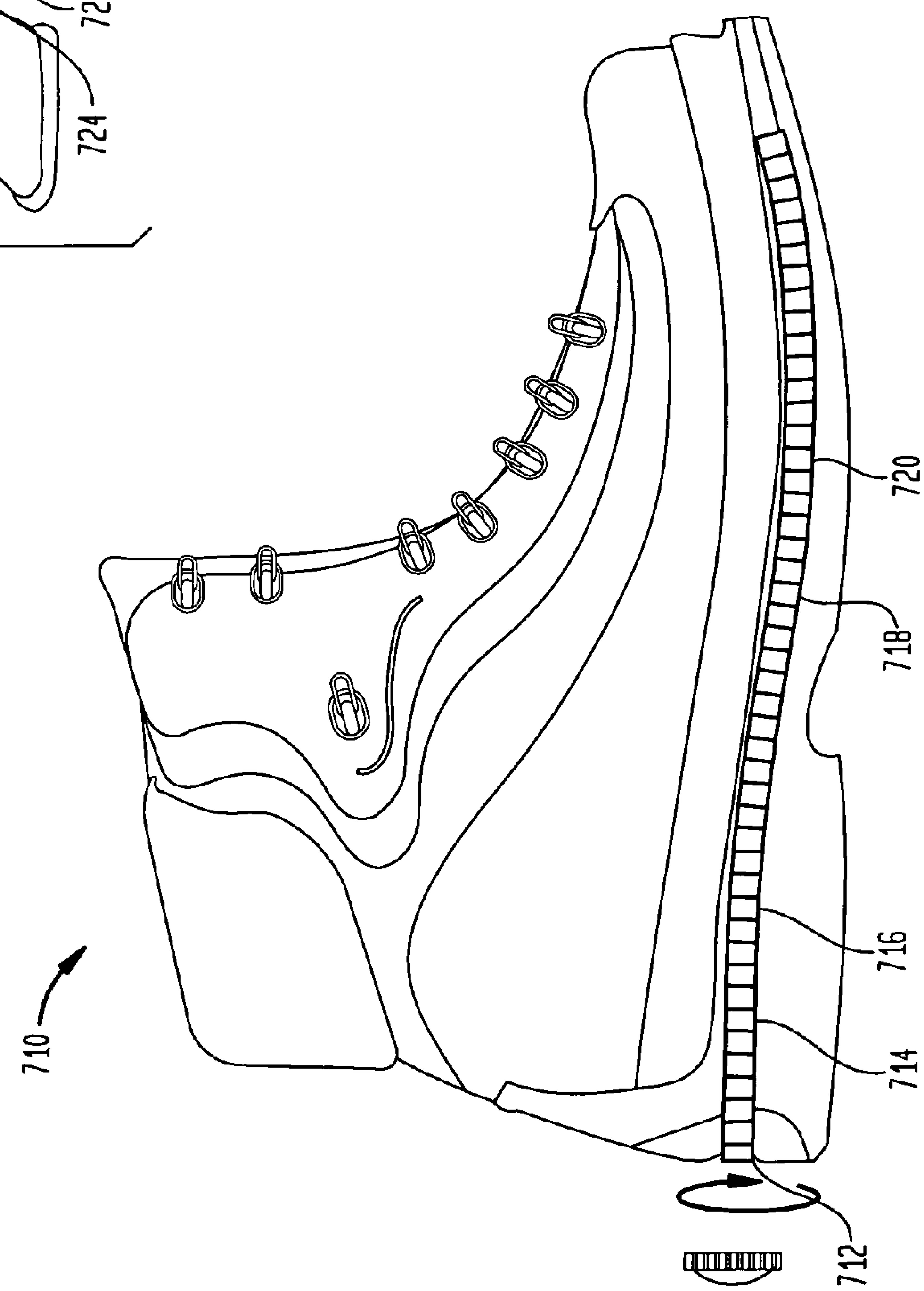


FIG. 18

FIG. 21

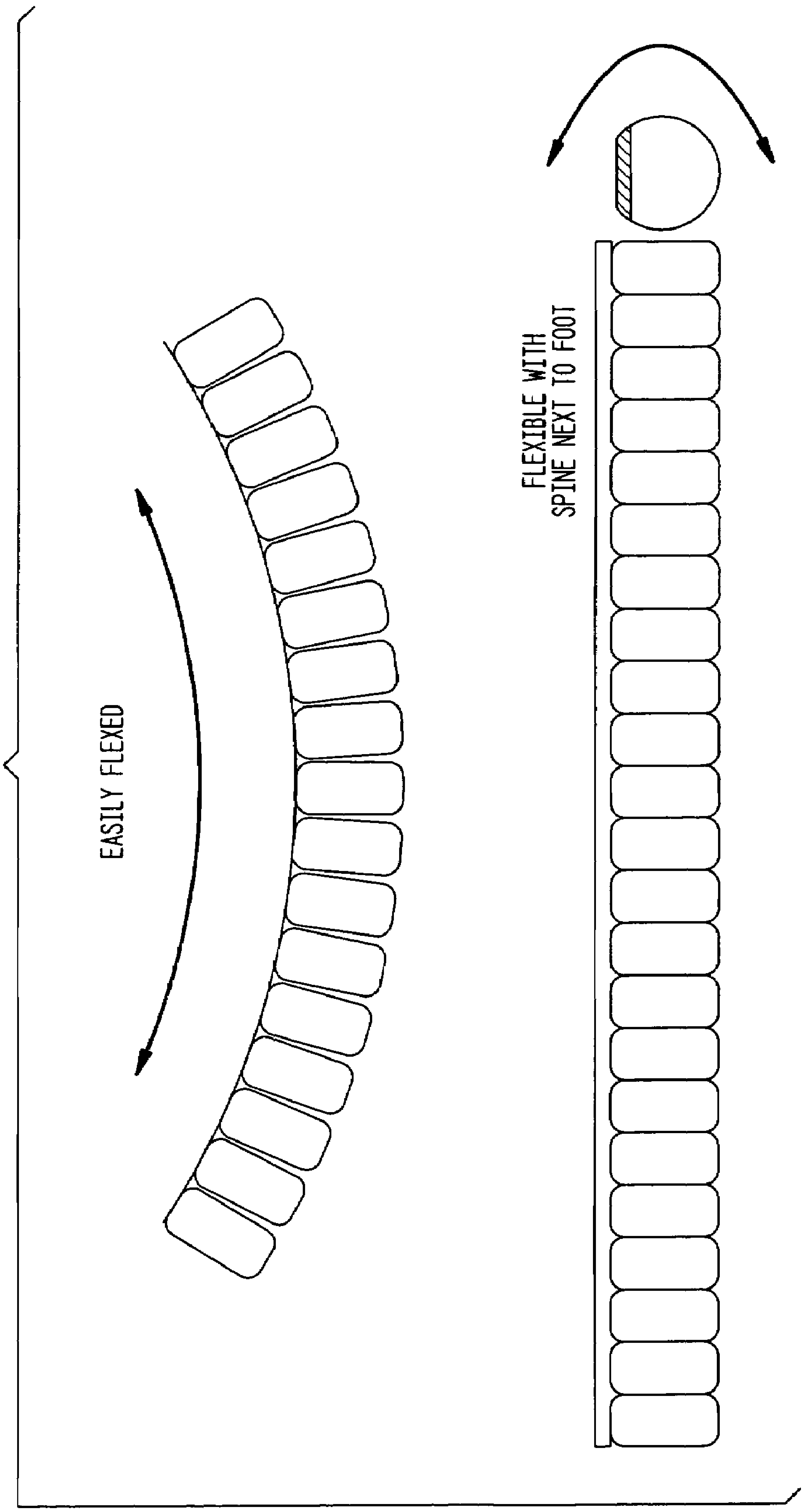


FIG. 22

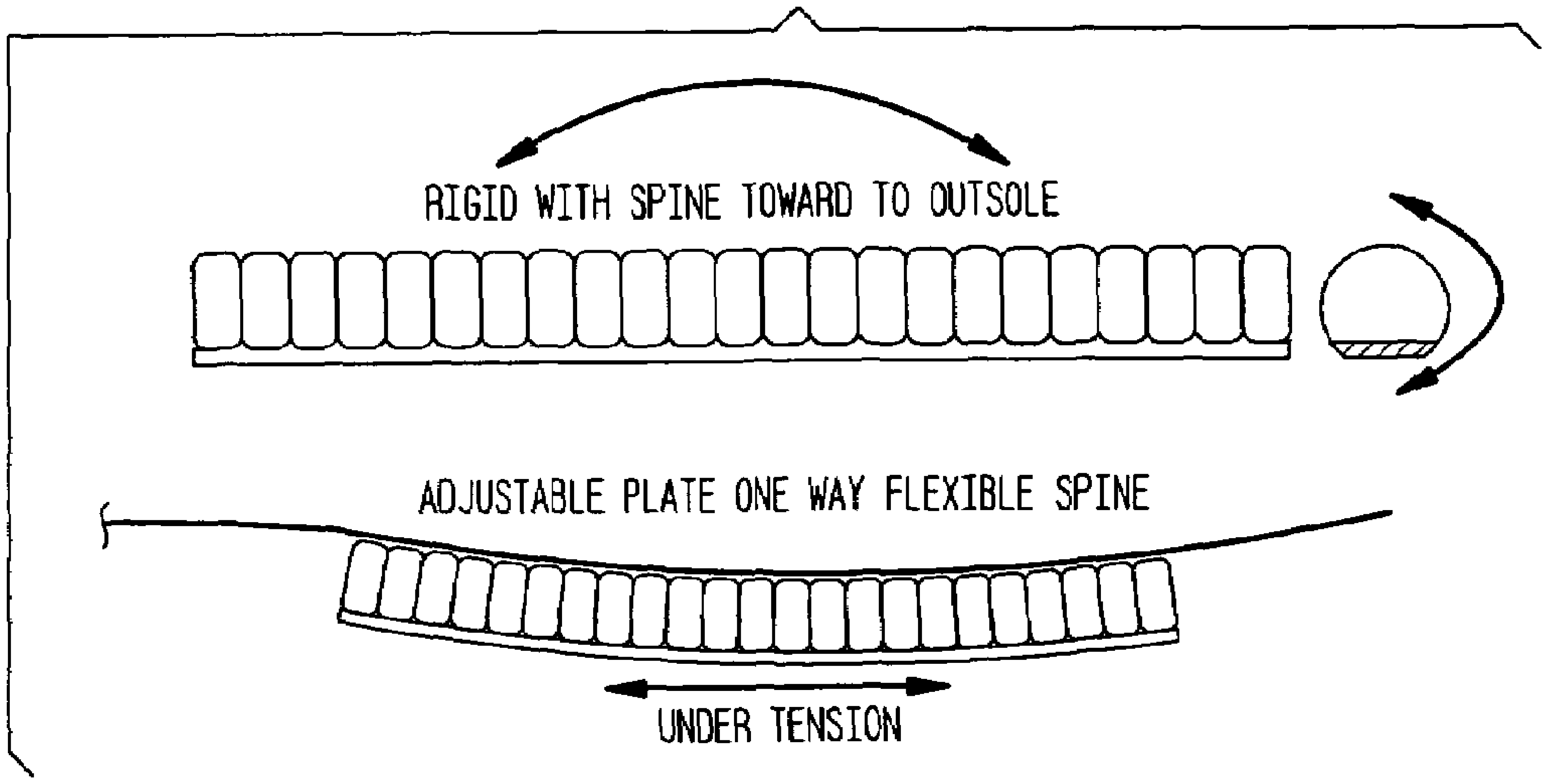
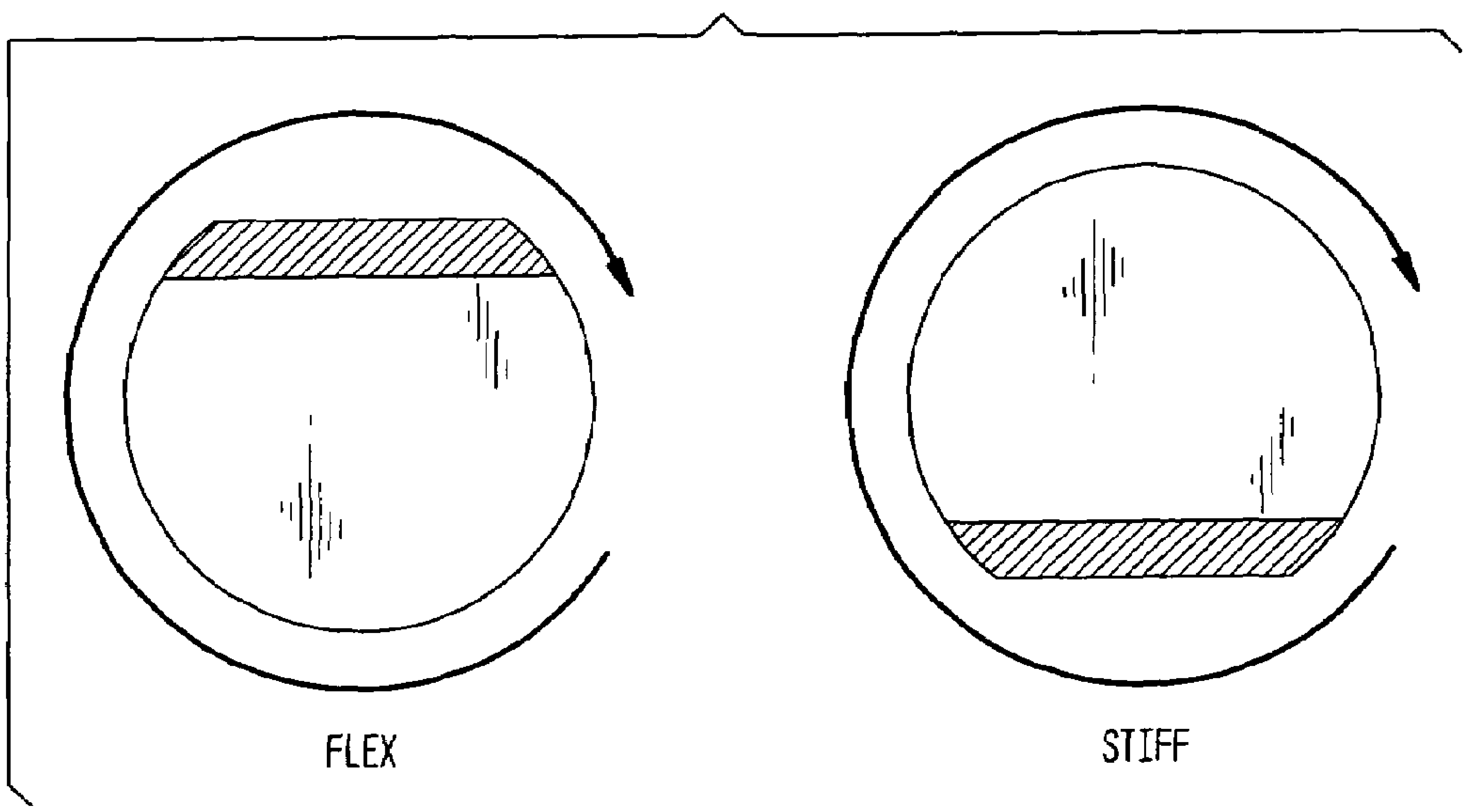

RIGID WITH SPINE TOWARD TO OUTSOLE
ADJUSTABLE PLATE ONE WAY FLEXIBLE SPINE
UNDER TENSION

FIG. 23


FLEX
STIFF

FOOTWEAR ARTICLE WITH ADJUSTABLE STIFFNESS

BACKGROUND OF THE INVENTION

Contemporary footwear is typically designed for much more specific uses than footwear of the past. This is evidenced by the fact that a person may own numerous articles of footwear, for varying activities and situations. Among other types of footwear, a person may have several pairs of dress shoes, several pairs of sneakers or other athletic footwear for different exercising activities such as cross-training, and footwear adapted for cold or inclement weather wear. In addition to these standard articles of footwear, there exists footwear adapted for very specific activities. For example, hiking or trail running may require different types of boots/sneakers depending upon the type of terrain being traversed.

Despite the sheer amount of differing footwear, situations often arise where footwear adapted for a specific activity is required to be utilized in connection with a different activity. For example, varying terrain encountered during a hike or trail run may require footwear with differing sole stiffness. The level of stiffness/flexibility of the sole necessarily determines the amount of flexibility allowed in the footwear. While a hiker walking on flat ground may desire an article of footwear with a more flexible sole, a stiffer sole may be desirable while hiking rocky or steep terrain. Given the fact that most hiking trails vary from flat to steep and bumpy terrain, a single boot/sneaker may not be capable of providing the most desirable comfort to its wearer. In addition, other such situations exist in which a different sole stiffness may be desired or required. For instance, boots/shoes designed for wear at a construction or other similar jobsite may be manufactured with a stiff sole to be suitable for wearing while working. However, the same boots/shoes may not be properly adapted for driving or walking to the jobsite or non-work related activities.

Heretofore, multiple pairs of footwear have been required for adaptation to particular activities. Depending upon the activity, this may necessarily require a wearer to carry different types of footwear at a given time. For example, as mentioned above, a hiker may ideally wish to carry and change footwear depending upon the terrain encountered, and a worker may ideally wear one article of footwear on his/her commute to work, and another while on the jobsite. Thus, it would be desirable and advantageous to provide a single article of footwear that allows for differing sole stiffness.

Therefore, there exists a need for articles of footwear having adjustable sole stiffness.

SUMMARY OF THE INVENTION

A first aspect of the present invention is an article of footwear. The article of footwear according to this first aspect preferably includes an upper defining a cavity for receiving a foot, a sole unit attached to the upper and an adjustable shank adapted to adjustably vary the stiffness of the sole unit. Preferably, the adjustable shank is contained within the article of footwear. In certain embodiments, the adjustable shank includes a plurality of segments forming a one-piece plate, where the segments are connected to one another through, for example, flex points like living hinges. In one particularly preferred embodiment, the adjustable shank includes four segments and three flex points. In others, the adjustable shank includes a plurality of individual, separate segments capable of cooperating with each other. Such separate segments may cooperate with each other through, for instance, tongue and

groove members. The article of footwear may further include means for increasing and/or decreasing the stiffness of the adjustable shank. In certain embodiments, the means may be at least one tensioning member, such as a cable, where application of a positive or negative tensioning force to the tensioning cable increases or decreases the stiffness of the sole unit of the shoe. In other embodiments, the means may be at least one adjustable stiffening member, such as a rod, and an adjustment mechanism for causing the adjustable stiffening rod to engage one or more additional segments.

In certain further embodiments of the first aspect, the article of footwear includes an outsole and a midsole, ad the adjustable shank may be located either within the outsole, between the outsole and the midsole or within the midsole, among other locations. In certain cases, the adjustable shank may be located in a channel formed in a portion of the footwear, such as in the outsole. Further, it is noted that the article of footwear in accordance with the present invention may include an adjustment mechanism for adjusting the adjustable shank, such mechanism being capable of cooperating with various portions of the shoe, such as the sole unit and/or upper. In addition, a tension limiter may be couple to the adjustment mechanism and adjustable shank in order to dictate a maximum and minimum amount of tensioning force that may be applied to the adjustable shank. Still further, the adjustable shank may include support blocks to increase the comfort of a wearer of the footwear.

A second aspect of the present invention is an adjustable shank member for use in an article of footwear. The adjustable shank member preferably includes a plurality of segments and an adjustment assembly for adjusting the cooperation between the plurality of segments. The adjustable shank member is preferably adapted to vary the stiffness of a sole unit of the article of footwear. The adjustment assembly for adjusting the cooperation between the plurality of segment may include at least one tensioning cable, where application of a tensioning force to the at least one tensioning cable increases or decreases the stiffness of the sole unit. The adjustment assembly may also include at least one adjustable stiffening rod, and an adjustment mechanism for causing the adjustable stiffening rod to engage one or more additional segments. Other means are also envisioned, as are similar variations to those described above in relation to the first aspect of the present invention. For example, it is envisioned to provide an adjustable shank member having four segments coupled together by three flex points.

A third aspect of the present invention is a method of adjusting the stiffness of an article of footwear. The method preferably includes the steps of providing an article of footwear having an adjustable shank in cooperation with a sole unit therein, the adjustable shank being contained within the article of footwear, and operating an adjustment mechanism associated with the adjustable shank, the adjustment mechanism being at least partially connected to the article of footwear. Preferably, the operating step manipulates the relationship between segments of the adjustable shank to alter the stiffness. In certain embodiments, the operating step causes movement of the segment of the adjustable shank with respect to one another. In addition, the operating step may include applying tension to a tensioning cable in order to achieve the method in accordance with the third aspect or causing a rod to engage selected segments of the adjustable shank to achieve same. The adjustment mechanism or adjustment interface may be internally or externally coupled to the adjustable shank. By way of example only, a footbed of the article of footwear may be removed, the adjustment mechanism may be coupled to the adjustable shank at a position within the article of footwear, adjustment may be made as needed, the adjustment mechanism may be decoupled and then the footbed may be replaced in the article of footwear.

A fourth aspect of the present invention is an interface such as a handle for use with an article of footwear. The adjustment interface may include a body capable of cooperating with a portion of the article of footwear, where actuation of the handle varies the stiffness of a sole unit of the article of footwear. Such an adjustment interface, according to this fourth aspect, may be utilized in conjunction with the above described three aspects of the present invention. In certain embodiments, the adjustment interface may be attached to a portion of the article foot, such as an upper or sole unit of the shoe.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the subject matter of the present invention and the various advantages thereof can be realized by reference to the following detailed description in which reference is made to the accompanying drawings in which:

FIG. **1** is a side perspective view of an article of footwear in accordance with the present invention.

FIG. **2** is a top perspective view of the article of footwear shown in FIG. **1**.

FIG. **3** is a partial side cross sectional view of the article of footwear shown in FIG. **1**, depicting the cooperation between the shoe and an adjustable shank.

FIG. **4**A is a bottom perspective view of a first embodiment of an adjustable shank for use in accordance with the present invention.

FIG. **4**B is a bottom perspective view of the adjustable shank shown in FIG. **4**A, employing an adjustment limiter.

FIG. **5** is a top perspective view of a tension limiter shown in FIG. **4**B.

FIG. **6** is a top perspective view of a second embodiment of an adjustable shank for use in accordance with the present invention.

FIG. **7** is a top perspective view of a third embodiment of an adjustable shank for use in accordance with the present invention.

FIG. **8**A is an enlarged side view of a tongue and grove joint formed between the segments of the adjustable shank shown in FIG. **7**.

FIG. **8**B is an enlarged side view of another tongue and grove joint formed between the segments of the adjustable shank shown in FIG. **7**.

FIG. **9** is a top perspective view of a variation of the adjustable shank shown in FIG. **7**.

FIG. **10** is a cross sectional side view of the cooperation between the tubular elements of the adjustable shank shown in FIG. **9** taken along line **1-1** of FIG. **9**.

FIG. **11**A is a top perspective view of a fourth embodiment of an adjustable shank for use in accordance with the present invention, with the stiffening rods disengaged.

FIG. **11**B is a top perspective view of the adjustable shank shown in FIG. **11**A, with the stiffening rods engaged.

FIG. **12** is a top perspective view of a fifth embodiment of an adjustable shank for use in accordance with the present invention.

FIG. **13** is a cross sectional view of a stiffening element for use in conjunction with the fifth embodiment depicted in FIG. **12**.

FIG. **14** is a perspective view of a sixth embodiment of an adjustable shank for use in accordance with the present invention.

FIG. **15** is a bottom view of the sixth embodiment adjustable shank depicted in FIG. **14**.

FIG. **16** is a rear view of the article of footwear shown in FIG. **1**.

FIG. **17** is a side view of the article of footwear shown in FIG. **1**, with a concentration on operation of an adjustment mechanism.

FIG. **18** is a side view of an article of footwear in accordance with a seventh aspect of the present invention.

FIG. **19** is a rear view of the article of footwear depicted in FIG. **18**.

FIG. **20***a* is a longitudinal view of an adjustable shank utilized in the seventh embodiment.

FIG. **20***b* is a side view of the adjustable shank depicted in FIG. **20***a*.

FIG. **21** is an illustration depicting the operation of the adjustable shank depicted in FIG. **20***a*, when in a flexible position.

FIG. **22** is an illustration depicting the operation of the adjustable shank depicted in FIG. **20***a*, when in a rigid position.

FIG. **23** is an illustration depicting the adjustable shank depicted in FIG. **20***a* in both flexible and rigid positions.

DETAILED DESCRIPTION

In describing the preferred embodiments of the invention illustrated in the appended drawings, specific terminology will be used for the sake of clarity. However, the invention is not intended to be limited to the specific terms used, and it is to be understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

Referring to the drawings, wherein like reference numerals refer to like elements, there is shown in FIGS. **1** and **2**, in accordance with various embodiments of the present invention, a footwear article or shoe, designated generally by reference numeral **10**. As will be discussed further below, shoe **10** is designed to allow for adjustment of the stiffness of its sole unit **11**, and thus enhance the stability, support and comfort of a wearer. It is noted that shoe **10** may be any type of conventional footwear type, including, but not limited to dress shoes, loafers, athletic shoes such as sneakers, work boots, hiking boots, sandals, etc. As shown in the preferred embodiment of FIG. **1**, shoe **10** includes an outsole **12** and an upper **14**. Outsole **12** may include a tread **16** on its bottom, and is preferably connected to upper **14** by a region **18**. In certain embodiments, region **18** may be integral with outsole **12**, while in other embodiments, it may comprise a separate midsole, a lasting board, etc. In still further embodiments, outsole **12** and upper **14** may be integrally formed as a single piece. Shoe **10** may also include additional features, such as an arch support (not shown), which may be fixed as part of shoe **10** or removable therefrom.

Upper **14** may include a body **20**, as well as a collar region **22**. Collar region or collar **22** preferably defines an opening that enables a wearer to insert his or her foot into an interior cavity **24** of body **20**. Collar **22** may include a top portion **23** of upper **14**, as well as certain portions of upper **14** which extend therebelow. Depending upon the height of shoe **10** about a wearer's ankle, collar **22** may extend many inches below top portion **23**. In accordance with certain aspects of the present invention, it is preferable for collar **22** to be above the instep of a wearer, in most shoe structures. Preferably, collar **22** has a tongue **26**, which the wearer can pull to simplify putting on shoe **10**, and body **20** desirably includes laces **28** or other fasteners (such as hook and loop fastening straps, snaps, clips, or the like) useful in securing the wearer's foot in shoe **10**.

Shoe **10** also preferably includes a footbed **30** (best shown in FIGS. **2** and **3**) which is configured to receive and support a wearer's foot within interior cavity **24**. Well known types of footbeds **30** may be utilized in conjunction with the present invention, including custom orthotics, sockliners and the like. Footbed **30** may be formed from resilient materials such as ethyl vinyl acetate ("EVA"), polyurethane ("PU") foams, or other such materials commonly used in shoe midsoles, insoles or sockliners. Footbed **30** may be manufactured using multiple material layers, regions and/or segments, which may each have a different thickness and/or a different rigidity. For example, footbed **30** may comprise multiple layers of different rigidity material. Alternatively, footbed **30** may have different levels of rigidity in the forefoot, instep and heel regions of shoe **10**. Finally, footbed **30** may also have a first segment about the first metatarsal of a first rigidity and a second segment about the fifth metatarsal of a second rigidity. It is noted that, in certain embodiments, outsole **12**, region **18** and footbed **30** may be collectively referred to as sole unit **11**. However, shoes **10**, in accordance with the present invention, may employ sole units **11** which include only certain of those individual elements or that utilize additional elements such as an arch support.

As best shown in the partial cross sectional view of FIG. **3**, shoe **10** also includes a component **32**, such as an adjustable shank, which may be a variety of different designs that include different elements. Certain of these designs will be discussed further below, with the general adjustable shank element being consistently referred to throughout with reference numeral **32**. The exemplary adjustable shank depicted in FIG. **3** is denoted with general reference numeral **32**, and is further discussed below in reference to a seventh embodiment. In accordance with the present invention, adjustable shank **32** is designed so as to vary the stiffness of sole unit **11** of shoe **10**. Thus, the above discussed shortcomings of regular shoes, with regard to sole stiffness, may be avoided and the comfort of the wearer improved. In its most general form, shank **32** may include one or more elements or segments which are capable of being manipulated to change a stiffness property of sole unit **11**, and thereby the flexibility of footwear upon engagement by a wearer's foot with in shoe **10**. The operation of shank **32** may involve moving these elements or segments with respect to one another or with respect to different portions of shoe **10**. Preferably, the operation of adjustable shank **32** may be conducted while the foot of a wearer is disposed within body **20** of upper **14**.

However, it is clearly envisioned to provide a design which includes an adjustable shank **32** that preferably requires removal of the foot of a wearer and/or is more easily manipulated with the foot removed from shoe **10**. For example, designs of shank **32** are envisioned in which it is necessary and/or desirable to first remove a foot from shoe **10** before adjusting the shank. Such a design may allow for a wearer to better visualize the particular position of shank **32** and thereby better determine the stiffness of sole unit **11**.

Preferably, shank **32** is capable of being operated by an adjustment mechanism which may be located on any portion of shoe **10**. As will be further discussed below, this adjustment mechanism may be many different designs, and, in certain embodiments, may be adapted for use with particular shoe constructions. For example, an adjustment mechanism that is suitable for use in conjunction with a sandal or the like may not be suitable for use with a hiking boot or the like. It is also noted that the particular design of this adjustment mechanism may be such that it provides an aesthetically pleasing addition to shoe **10**, which also may vary depending upon the type of shoe **10** being manufactured.

Shank **32** is shown in the preferred embodiment of FIG. **3** as being located between outsole **12** and midsole **18**. However, it is to be understood that shank **32** may be placed at any position within or attached to sole unit **11** of shoe **10**. For example, in other embodiments, shank **32** may be located entirely in outsole **12**, entirely in midsole **18**, between midsole **18** and footbed **30**, or above footbed **30**, among other contemplated locations. Certain limitations with regard to the position of adjustable shank **32** may be its ability to vary the stiffness of sole unit **11** and thus the comfort of the wearer of shoe **10**. Further, the position of shank **32** may also be dictated by the particular shoe type and the adjustment mechanism utilized in conjunction therewith. Still further, it is noted that the position of shank **32** should be such that it does not interfere with the overall comfort of shoe **10** for a wearer, and, in certain embodiments, the operation of the shank with the foot of the wearer disposed within body **20** of upper **14**.

In accordance with certain preferred embodiments, adjustable shank **32** is preferably situated and integrated into shoe **10** as provided below. For example, adjustable shank **32** can be a layer on or between other common footwear components such as outsole **12**, midsole **18**, lasting board (not shown), and footbed **30**. Most preferably adjustable shank **32** is joined to either the top or bottom of midsole **18**. This may enable midsole **18** to accommodate any irregular, non-flat shapes or projections coming from component **32**. For instance, adjustable shank **32** may be situated between midsole **18** and outsole **12**. In such a construction, a flat side of adjustable shank **32** would preferably be next to outsole **12** with a non-flat side preferably being adjacent to midsole **18**. Because midsole **18** is preferably made from compliant foam materials, such as Polyurethane (PU), Ethylvinylacetate (EVA), Latex, or Polyvinylchloride (PVC) foam using either injection molding or compression molding techniques, it can easily be matched to a contour of adjustable shank **32**. In addition, midsole **18** can be injected or compressed directly to adjustable shank **32**. In certain embodiments, cements may be used to join outsole **12** to adjustable shank **32**, and the adjustable shank **32** to midsole **18**. Of course, in other embodiments, the same adjustable shank **32** may be placed on top of midsole **18** with the non-flat surface of adjustable shank **32** facing the midsole (flipped over as compared to when adjustable shank **32** is on top of the outsole), in order to provide the same functionality.

Thus, the exact placement of adjustable shank **32** can vary depending on the shoe type and desired outcome. For example, as set forth above, adjustable shank **32** may be glued or cemented (in a manner where the shank is adjustably operable) between outsole **12** and midsole **18**. In other embodiments, outsole **12** may include a specially adapted channel for housing adjustable shank **32** therein. In arguably its most simplistic positioning and integration, adjustable shank **32** may be attached to midsole **18** by well known methods such as gluing, and footbed **30** may be laid upon it. It is noted that the particular construction of adjustable shank **32** may adapt it to be better situated in certain positions than others. Finally, it is also noted that the particular construction of shoe **10** (e.g.—boot, sandal, etc. . . .) may lend itself to having adjustable shank **32** disposed in certain better positions.

Several different embodiments of adjustable shanks **32** will now be discussed. It is noted that while certain of these adjustable shanks **32** are described herein and depicted in the accompanying figures, other embodiments, as well as variances of those shown are contemplated and clearly fall within the scope of the present invention. In a first embodiment, adjustable shank **32** preferably comprises a unitary plate **34** of any number of segments **34***n*, each connected to adjacent segments by respective flex points **35***m*. In a preferred design of this first embodiment, as shown in FIG. **4**A, plate **34** includes four segments **34***a*, **34***b*, **34***c* and **34***d*. Each of segments **34***a*, **34***b*, **34***c* and **34***d* are preferably separated from each other by respective flex points **35***a*, **35***b* and **35***c*. It is noted that in this preferred design, segment **34***a* preferably corresponds to the heel section or rearfoot area of a human foot, while segments **34***b*, **34***c* and **34***d* correspond to the front area or forefoot of the foot. Once again, while only four segments **34***a*, **34***b*, **34***c*, and **34***d* are illustrated, it should be understood that any number of segments **34***n* and flex points **35***m* may be employed.

The general construction of plate **34**, as well as the other embodiments of adjustable shank **32** discussed herein, should be such that a foot inserted into shoe **10** is capable of flexing in its typical anatomical fashion when positioned in the shoe **10**. As the heel section of a human foot is rather inflexible, segment **34***a*, of the preferred embodiment depicted in the figures, is preferably designed so as to be firm and/or stiff. However, the front section or forefoot area of a human foot is generally flexible, and thus, flex points **35***a*, **35***b* and **35***c* provide flexibility to forefoot segments **34***b*, **34***c* and **34***d* (with respect to each other and segment **34***a*), in this same preferred construction. Ideally, in the preferred embodiment depicted in the figures, flex points **35***a*, **35***b* and **35***c* are positioned along plate **34** so as to divide the plate into segments **35***a*, **35***b*, **35***c* and **35***d* which correspond to the rearfoot region, tarsal region, metatarsal region and toe region of a human foot respectively. However, other configurations are also envisioned. In the embodiment shown in FIG. **4**A, flex points **35***a*, **35***b* and **35***c* are living hinges. Essentially, these living hinges include an area of thin material between adjacent segments **34***b*, **34***c* and **34***d* of thicker material, and are adapted to allow for the flexing of the adjacent segments **34***b*, **34***c* and **34***d* with respect to one another. In other embodiments, these flex points **35***a*, **35***b* and **35***c* may be sections of differing (e.g., more flexible/inflexible) material, rather than simply more or less material. Preferably, the aforementioned living hinges are designed so as to allow the adjacent segments **34***a-c* to flex in one direction, but not the other, or to minimize flexing in the other direction. This provides for flexibility which more closely mimics that of the flexibility of a normal human foot, while providing for a supportive surface from which to push off from when walking over ground. It is also noted that the various segments **34***n* may be individual segments which are capable of moving with respect to one another.

In accordance with the above, unitary plate **34** may be constructed of any material suitable for providing the necessary flexibility and durability characteristics needed for use in shoe **10**. For example, it is possible to construct plate **34** of certain polymer and metallic materials, such as thin stainless steel, thermoplastic urethane (TPU), hytrel, nylon, pebax, and EVA, or combinations thereof. Ultimately, the minimum and maximum stiffness that may be provided to sole unit **11** will be determined by the materials and configuration of both sole unit **11** and plate **34**. For example, in hiking boots or the like, where the material utilized in the construction of sole unit **11** is rather durable and strong, relatively stronger materials may be required in the construction of plate **34**. Otherwise, manipulation of the plate **34** may be insubstantial in varying the stiffness of sole unit **11**. Similarly, in a shoe **10** designed for less rugged use (e.g., a sandal or the like), the design of plate **34** should be such that the plate **34** does not necessarily increase the stiffness to a level which makes the shoe overly stiff or otherwise denigrates the intended function of the shoe. Therefore, it is contemplated to provide different constructions of plates **34** for different model shoes **10** or as removable inserts for the same model. It is also to be understood that relatively less flexible materials may be utilized in the construction of sole unit **11**, should shank **32** be of a hardier construction. Clearly a balance is necessary in matching the correct plate **34** to the correct shoe **10** and sole unit **11**. This may also vary depending upon the type of footwear for which plate **34** is being utilized in conjunction with. In addition, plate **34** may also be designed so as to include arched or contoured sections which allow for better cooperation with shoe **10**. For example, many shoes include an arched section that is designed to support the natural anatomical arch of the human foot. Plate **34** may include curved surfaces that cooperate with such an arch. This may increase the overall comfort for the wearer. However, such cooperative curved surfaces should not interfere with the operation of plate **34**.

In this first embodiment, adjustable shank **32** also preferably includes a tension cable **36**. As shown in FIG. **4**A, tension cable **36** may be situated so as to extend along an approximate midline of plate **34**, across or through each segment **34***n*, while at the same time crossing over each flex point **35***m*. However, it is clearly envisioned to situate cable **36** in any other position across any of the provided segments and/or flex points. In a most preferred embodiment shown in the figures, cable **36** is arranged in a channel **38** or the like formed in and across segments **34***a*, **34***b*, **34***c* and **34***d* and flex points **35***a*, **35***b* and **35***c*. However, a channel such as this is not necessary. In a preferred embodiment, cable **36** is constructed of steel braided cable, but may be may other types of material suitable for use with plate **34**. For example, cable **36** can be made of any suitable material that is strong enough to provide the necessary resistance in the operation of shank **32**. Such suitable materials could include, among other materials, stainless steel braided cables, extruded plastic line and monofilament line, like that commonly used as fishing line. Preferably, it is advantageous to utilize materials which have little to no elongation characteristics when placed in tension. Although not necessary, this may allow for finer control of shank **32**, and thus stiffness adjustment of shoe **10**, as the user does not have to account for stretch in the line.

A first end of cable **36** is preferably attached to a distal segment, such as segment **34***d* in the preferred embodiment shown, at a first attachment point **40**. A second end of cable **36** may be attached to an adjustment mechanism **42**, which will be further discussed below. Finally, as FIG. **4**A depicts the bottom of shank **32**, plate **34** may include several support blocks **44**, which are adapted to re-direct the force applied by the foot of a wearer to the various components of shank **32** (e.g.—cable **36** and channel **38**). These support blocks **44** are essentially raised areas which absorb the bulk of the force applied by the foot and allow for the components of shank **32** to operate in an ordinary fashion, without the downward weight caused by a wearer's foot adversely impeding operability of shank **32** so as to negate adjustability. Depending upon their positioning, support blocks **44** may provide further comfort to the wearer by better supporting a foot in shoe **10**.

The aforementioned adjustment mechanism **42** may be of many different constructions. For example, as shown in FIG. **4**A, mechanism **42** is an adjustment interface such as a handle that may be rotated to selectively apply/remove tension from cable **36**. In such a construction, as the handle is turned, it preferably operates a screw (not shown) that selectively applies or removes tension from cable **36**. Preferably, the handle may be pivoted so that there are two positions: 1) stored and 2) ready to adjust. In the aforementioned stored position the handle may fit into a recessed area (not shown) of adjustable shank **32** upper **14**, midsole **18** or elsewhere, such that it does not protrude from the shoe **10** and create a tripping hazard. On the contrary, when it is time to adjust the tension of cable **36**, the handle may be pivoted out of such recessed area, turned to adjust the tension, and then returned to the recessed area. However, it is also contemplated to provide other designs for the adjustment interface, such as a lever, dial, knob or other components like those which that will be discussed further below. Similarly, adjustment mechanism **42** may be located proximate to or adjacent shank **32**, or may be located a distance away. For example, it is contemplated to situate shank **32** between outsole **12** and midsole **18** (as shown in FIG. **3**) and mechanism **42** adjacent to upper **14**. Depending upon the particular construction of mechanism **42** and its cooperation with shank **32**, certain situations may be more preferable.

In operation, applying tension to tensioning cable **36** (via mechanism/handle **42**), effectively stiffens the joints created between segments **34***n* by flex points **35***m*. Absent a tensioning force being applied to cable **36**, flex points **35***m* are generally free to flex under normal conditions, but with such a tensioning force being applied to cable **36**, the flex points are essentially forced to act more rigidly or stiffly. This may be due, at least in part, to the particular shape of flex points **35***m*. In a preferred embodiment, these points are configured and shaped so as to allow for their reduction in area upon the application of a tensioning force thereto. This necessarily brings the individual segments **34***n* towards one another and thus limits flexibility of plate **34**. As the flex points **35***m* are, for the most part, located in the forefoot area of shoe **10**, the flexibility/stiffness of that area is controlled by this operation. Thus, the aforementioned flexible forefoot portion of a wearer's foot may be allowed to retain its normal flexibility or normal flexibility can be reduced if shank **32** is caused to become stiffer through adjustment of tensioning cable **36**. As briefly mentioned above, handle **42** may be operated in order to selectively apply/remove tension to cable **36**. Preferably, as in the embodiment shown in FIG. **4**A, handle **42** is rotated in a first direction (e.g., clockwise) to apply tension and in a second direction (e.g., counterclockwise) to release, minimize or otherwise reduce such tension. However, as mentioned above, other designs are possible.

In the above discussed first embodiment (shown in FIG. **4**A), it is noted that the tension provided to cable **36** may theoretically be infinitely adjustable, with the upper level of tension being determined by the weakest of the mechanical durability of cable **36**, mechanism **42**, and first attachment point **40**. This may clearly affect the upper and lower limits of stiffness/flexibility of plate **34**, with the construction of the plate also playing a part. Nevertheless, it may be desirable to control the overall minimum and maximum tension of cable **36**. In order to do so, FIG. **4**B illustrates a similar design to that shown in FIG. **4**A and discussed above. All of the different components of this design are substantially similar, with the addition of a tension limiter **46** to shank **32**. However, situated on segment **34***a* in the rearfoot area of shoe **10**, limiter **46** is adapted to provide a maximum and minimum stop that correlates to the minimum and maximum tension of cable **36**. This, in turn, controls the maximum and minimum stiffness provided by plate **34**. In other words, limiter **46** is essentially a mechanical stop and may be placed anywhere within the mechanical chain that creates upper and/or lower bounds for the movement of the tensioning cable. As shown in FIG. **4**B, limiter **46** is positioned within the heel region of shank **32**. It is noted that the maximum and minimum stiffness allowed by limiter **46** should be such that it correlates with the intention of shoe **10**. For example, for a lighter use shoe, such as a sandal, limiter **46** should allow for a low maximum stiffness. Alternatively, for a hiking boot or the like, limiter **46** should allow for a relatively high maximum stiffness. Thus, limiter **46** may itself be adjustable.

As shown in the more detailed view of limiter **46** in FIG. **5**, limiter **46** preferably includes a body (labeled with reference numeral **46**) which fits within a similarly shaped and sized channel **47** in adjustable shank **32**. Essentially, upon operation of mechanism **42**, to either increase or decrease the tension of cable **36**, limiter **46** will move within channel **47**. When a maximum tension of cable **36** is achieved, limiter **46** will preferably engage a first side **47***a* of channel **47**, and prevent any further movement of limiter **46**, and thusly additional tension to be applied to cable **36**. Likewise, when a minimum amount of tension of cable **36** is achieved, limiter **46** will preferably engage a second side **47***b* of channel **47**, thereby preventing further movement of limiter **46**, and retaining at least a minimum amount of tension in cable **36**. Clearly, the depiction of limiter **46** in FIG. **5** is but one relatively straight forward implementation of the limiter concept. It is envisioned to provide differently shaped and/or sized limiters, as well as those which employ additional components, such as springs or the like.

A second embodiment of adjustable shank **32** is depicted in FIG. **6**. This second embodiment is similar in design to that of the above discussed first embodiment. For ease of description, like elements to those of the first embodiment will be labeled with similar reference numerals, within the 100-series of numbers. For example, the second embodiment shank **32** comprises unitary plate **134** that preferably includes four segments, **134***a*, **134***b*, **134***c* and **134***d* separated by flex points **135***a*, **135***b* and **135***c*. (As in the above discussion of the first embodiment, plate **134** may have more or less than the 4 segments and 3 flex points depicted in the drawings.) In fact, the only essential difference from the first embodiment, aside from certain insignificant structural differences, is that plate **134** includes, in addition to a similar central tensioning cable **136**, two perimeter tensioning cables **137***a* and **137***b*. These two perimeter tensioning cables are both preferably operated, along with cable **136**, by a tension adjusting handle **142** (similar to the one employed in the first embodiment). Perimeter cables **137***a* and **137***b* preferably provide for a more uniform or increased application of stiffness to the forefoot segments of **134**. As in the design of the first embodiment, the collective tensioning cables of the second embodiment provide for a stiffer plate **134** upon application of a tensioning force to them, and for a more flexible plate **134** upon removal of such a tensioning force. Nevertheless, the addition of two perimeter tensioning cables may increase the uniformity and application of stiffness to plate **134**. As is shown in FIG. **6**, perimeter cables **137***a* and **137***b* may be partially contained within channels **139***a* and **139***b* (similar to central channel **138**), and enclosures or tunnels **141***a* and **141***b*, respectively. However, other configurations are envisioned to guide perimeter cables **137***a* and **137***b*. Further, it is contemplated that the design of the second embodiment may be used in conjunction with a tension limiter, such as limiter **46** of the first embodiment. Operation of the second embodiment is preferably similar to that of the above described first embodiment.

In accordance with this second embodiment, it is envisioned to provide individual separate perimeter cables **137***a* and **137***b*, or to provide one cable that extends around plate **134**. In the latter case, the respective ends of the single cable would be connected or otherwise mechanically coupled with and operated by handle **142**. In addition, it is noted that handle

142 may be adapted to adjust all of the cables at the same time, or individually. For example, in the case of three separate cables **136**, **137***a* and **137***b*, handle **142** may be adapted to provide/release tension with one motion. Alternatively, the handle may include a selector or the like for determining which cable is to be manipulated.

Yet another embodiment of the adjustable shank **32** is depicted in FIG. **7**. Once again, like elements to those of the first embodiment will be labeled with similar reference numerals, but within the 200-series of numbers. For example, in this third embodiment, adjustable shank **32** comprises a plate **234** having a plurality of segments such as four separate segments **234***a*, **234***b*, **234***c* and **234***d*. Each of the segments are preferably tethered together by perimeter tension cables **237***a* and **237***b*, which may be shortened/lengthened by operation of a tension adjustment device such as handle **242** in a similar manner as that described in the above embodiments. As shown in FIG. **7**, segments **234***a*, **234***b*, **234***c* and **234***d* each preferably include tubular structures on their respective exteriors for receiving cables **237***a* and **237***b*. For example, segment **234***a* includes a tubular structure **250***a* for receiving tension cable **237***a* and a tubular structure **251***a* for receiving tension cable **237***b*. Similar structures, denoted by reference numerals **250** and **251** respectively, are included on each of the other segments, with the letter referring to the particular segment. Segment **234***a* may also include side walls **260** and/or an integral heel cup for receiving and supporting the wearer's heel. Once again, while shown in the drawings to have four segments, plate **234** may include any number of such segments **234***n* in other designs.

In this third embodiment, the different segments are adapted to move independently of each other to thereby vary the stiffness of sole unit **11**, without the use of a living hinge or the like. Thus, application of tensioning force to cables **237***a* and **237***b* preferably causes the different segments to move towards one another. Segments **234***a*, **234***b*, **234***c* and **234***d* are further preferably adapted to cooperate or interlock with other adjacent segments upon movement towards one another. As shown in FIG. **7**, and the more detailed views of FIGS. **8**A and **8**B, these segments may include tongue and groove type joints. For example, segment **234***a* may include a tongue **252***a*, and segment **234***b* may include a groove **254***b* (other segments preferably include at least one of tongue **252** or groove **254**, with letters referring to the particular segment). FIGS. **8**A and **8**B depict two different joint configurations. However, other configurations are clearly envisioned. In operation, upon application of a tensioning or shortening force to cables **237***a* and **237***b*, segments **234***a*, **234***b*, **234***c* and **234***d* are at least partly drawn together and thereby at least partly interlock through the cooperation of these tongue **252** and groove **254** joints. Upon the removal of such a tensioning or shortening force, the natural flexing movement of a human foot within shoe **10** preferably causes segments **234***a*, **234***b*, **234***c* and **234***d* to move apart from each other and restore flexibility to sole unit **11**.

It is noted that, depending upon the particular design of the tongue **252** and groove **254** joints, it is possible to achieve varying stiffening to sole unit **11**. For instance, a mechanism may be adapted to cooperate with cables **237***a* and **237***b* to slowly draw the different segments together. In certain embodiments, the tongue **252** and groove **254** joint may be designed to provide progressive stiffening depending on the level of interlock, so that a joint which is partially interlocked would preferably provide less stiffness to sole unit **11** than a joint which is fully interlocked. It is also noted that the individual nature of the segments of this third embodiment may clearly be applied to any of the embodiments discussed in the present application. One of ordinary skill in the art would understand the modifications necessary in order to construct such a design.

FIG. **9** depicts a variation of the above discussed third embodiment. In this variation, shank **32** is a multi-piece plate **334**, like plate **234** shown in FIG. **7**. Similar reference numerals are once again utilized for like elements. However, rather than perimeter cables **237***a* and **237** and perimeter tubular structures **250** and **251**, plate **334** includes more interiorly disposed cables **337***a* and **337***b* (one of which is at least partly shown in FIG. **10**) that cooperate with more interiorly disposed tubular structures **350** and **351** (which are denoted for each segment by like reference numerals with a letter designation). Instead of tongue and groove joints, like that of plate **234**, tubular structures **350**, **351** of plate **334** are designed to cooperate in a telescopic fashion with one another. As shown in the more detailed cutaway view of FIG. **10**, the tubular structures preferably include first sections **350'** and **351'** having smaller exterior diameters for extension into second sections **350"**, **351"** having larger interior diameters, of adjacent tubular structures. Clearly, the diameters of these sections should be dimensioned to allow proper cooperation therein. Essentially, these tubular sections take the place of the tongue and groove joints of the above discussed third embodiment. While shown as being circular, it is contemplated to provide tubular structures **350** and **351** having different shaped configurations. It is noted that aside from these structural differences, operation of plate **334** is substantially the same as operation of plate **234**. In certain embodiments, the tubular structures are preferably placed into grooves (not shown) in the midsole.

A fourth embodiment adjustable shank plate **32** is depicted in FIGS. **11**A and **11**B. This fourth embodiment preferably utilizes plate **434**, similar to those described in the above discussed embodiments, which include segments **434***a*, **434***b*, **434***c* and **434***d*. It is noted that the segments of plate **434** may be separated by flex points (like in the first embodiment), or may be individual segments (like in the third embodiment). As shown in FIGS. **11**A and **11**B, the segments are preferably individual segments as in the third embodiment, although flex points or other linkages may also be used. Essentially, the adjustable shank of the fourth embodiment is adjusted through the cooperation of a plurality of tunnels **480** and a telescopic stiffening element **482**, which desirably includes a plurality of stiffening rods **484**. It is noted that tunnels **480** are preferably located on each of the segments and are shown in the drawings with letter designations relating to the particular segment. Further, it is noted that the segments may include any number of tunnels **480** (preferably two) for cooperating with a like number of stiffening rods **484** of stiffening element **482**. As best shown in FIG. **11**A, stiffening members, such as rods **484** may be at least partly disengaged from tunnels **480** when a flexible sole unit **11** is desired, so that they reside along inflexible segment **434***a*. However, as shown in FIG. **11**B, stiffening element **482** may be operated so as to "join" the different tunnels **480** together. This clearly, allows for a stiffer sole unit **11** in its forefoot section. Stiffening element is preferably capable of being driven by a handle **442**, which upon its rotation, causes a main body of stiffening element **482** to ride along a threaded track **483** or the like. Clearly, the motion of body of element **482** may be in a different direction depending upon the direction of rotation of handle **442**. It is noted that stiffening rods **484** may be selectively positioned into tunnels **480**, so as to only connect certain of the aforementioned segments. Thus, the wearer can reduce the tension in the front of the shoe, e.g., between segments **434***d* and **434***c*, while maintaining stiffness between the plates **434***c* and

434*b*, and between **434***b* and **434***a*. This allows for the selective adjustment of sole unit **11** to the user's desired stiffness (e.g.,—allowing for selected stiffer sections within different areas of the foot). It is contemplated that a gauge or other system may be employed so as to allow a user to better determine the level of stiffness of sole unit **11** at a given time.

Still further, FIG. **12** depicts a fifth embodiment of the present invention. This fifth embodiment is similar in nature and operation to that discussed above in the fourth embodiment. As shown in FIG. **12**, the fifth embodiment adjustable shank **32** includes a plate **534** having segments **534***a*, **534***b*, **534***c* and **534***d*. Once again, as in the fourth embodiment, plate **534** may be separated by flex points **535***a*, **535***b* and **535***c* (like in the first embodiment), or may be individual segments (like in the third embodiment). However, rather than employing a stiffening element that is operated through the use of a handle or the like, plate **534** employs a series of channels **590**, **591** (with letters designating the particular segment which the channel is located on) and a plurality of manually positionable stiffening elements **592** for insertion into and sliding within channels **590** and **591**. In operation, a wearer simply positions any stiffening elements **592** in desired positions within channels **590**, **591**. As in the above fourth embodiment, stiffening elements **592** may be wholly disposed within segment **534***a*, when a wearer desires the least flexible sole unit **11**. However, the elements may be moved further into channels **590**, **591** so as to create a stiffer sole unit **11**. It is contemplated that stiffening elements **592** may be permanently contained within plate **534** and operated by various procedures conducted by the user, such as removing a midsole **30** and manually moving the elements, or through the use of a magnet which attracts the elements along channels **590**, **591**. It is noted that the latter means for moving the elements would only work if elements **592** were indeed of a metal construction, and the resistance of movement of such elements is rather small. However, other mechanisms for operation are envisioned. FIG. **13** depicts a cross section of an example stiffening element **592**. As shown in that figure, stiffening element **592** preferably includes a beveled and/or rounded edge **593** for allowing for a smoother movement through like shaped channels **590**, **591**. However, other shapes may be employed, such as wholly circular stiffening elements for placement and positioning in tubes or the like.

Yet another embodiment of adjustable shank **32** is depicted in FIGS. **14** and **15**. In fact, the adjustable shank depicted in these figures is not only a sixth embodiment shank **32**, but also that which is present in the representation of shoe **10** depicted in FIGS. **1**-**3**. It is noted that this sixth embodiment of adjustable shank **32** is similar in construction to that of the first and second embodiments. Namely, the sixth embodiment shank **32** preferably includes a unitary plate **634** employing two cables **636***a* and **636***b* for increasing/decreasing the stiffness of plate **634**. In addition, this embodiment includes an adjustment mechanism **642** for adjusting tension of cables **636***a* and **636***b*. As shown in FIGS. **14** and **15**, adjustment mechanism **642** is preferably of a ratchet and handle type design. This design preferably produces a straight pull on tension cables **636***a* and **636***b* without wrapping or otherwise using rotary motion to move the cable, like in the first embodiment shank **32** depicted in FIGS. **4***a* and **4***b*.

A common ratchet design for use with this sixth embodiment may be similar to that found on cycling shoes, and preferably includes a ratchet **644**, ratchet handle **646** and release mechanism **648**. This is shown further in FIG. **16**. Ratchet handle **646** preferably provides a mechanical advantage in order to move ratchet mechanism **648**, thus applying sufficient tension to cables **636***a* and **636***b* when the user desires additional stiffness in the shoe. This operation is best shown in FIG. **17** of the present application. Release mechanism **648** preferably releases a lock from ratchet **644**, thereby allowing the tension to be removed from cables **636***a* and **636***b* and flexibility restored to the shoe. It is noted that any well known ratchet design may be employed, as long as there exists a means for quickly and easily applying and releasing tension on cables **636***a* and **636***b*.

Referring to FIGS. **14** and **15**, a mechanical stop or other tension limiter **650** may also be included in the apparatus of adjustment mechanism **642**. Preferably, such a limiter **650** is placed in serial within ratchet **644**. As shown in FIGS. **14** and **15**, ratchet **644** preferably has a slot **652** cut into it with limiter **650** protruding into the slot. This provides an upper and lower limit to the tension produced, as the upper and lower end of slot **652** of ratchet **644** will come into contact with limiter **650** upon the application of too much or too little tension. This, in turn, limits the movement of ratchet **644** and, thereby limiting the tension applied to cables **636***a* and **636***b*. Of course, once again, the particular construction of this sixth embodiment may vary depending upon the type and/or size of shoe to employ such a design. In addition, it is noted that adjustment mechanism **642** may vary in its aesthetic appearance depending upon the style of shoe **10** being manufactured.

Finally, FIGS. **18**-**23** depict a seventh embodiment adjustable shank **32** of the present invention. As shown in FIG. **18**, this seventh embodiment shank includes a tube-like structure **714** placed within a channel **712** of a shoe **710**. Preferably, channel **712** is formed in a sole unit portion of shoe **710**, similar to that discussed above in relation to shoe **10**. Likewise, the remaining portions of shoe **710** are similar to that of above-discussed shoe **10**, with **710** also being capable of embodying many different variations in design and appearance. Tube structure **714**, as shown in the figures, is essentially a solid tube having a plurality of horizontal slits **716** formed therein, so as to create a plurality of connected segments **718**. It is noted that slits **716** are preferably formed only partially through tube **714**, thereby forming the aforementioned connected segments **718**. In addition, it is noted that slits **716** are preferably formed in the same direction, thus, not only creating segments **718**, but also resulting in at least one solid side **720**.

Preferably, tube **714** is of a circular cross section, and placed within a similar circular channel **712**. An adjustment mechanism **722** may also be provided, which, as shown in FIG. **18**, may be a dial structure capable of rotating tube **714**. In operation, a user would preferably rotate tube **714** depending upon the desired stiffness of shoe **710**. With solid side **720** facing or closest to the user's foot, segments **718** are preferably capable of bending with respect to one another during normal foot bending (best shown in FIG. **21**). This, in turn, allows for shoe **710** to bend with the user's foot. However, with solid side **720** facing away from or farthest from the user's foot, segments **718** can no longer bend with normal foot bending (best shown in FIG. **22**). Rather, segments **718** are forced towards one another, but clearly cannot impede upon each segment's particular space. This, in turn, prevents shoe **710** from significant bending. Finally, situating tube **714** so that solid side **720** is in a position between the two above-noted positions with respect to the user's foot may produce stiffness characteristics therebetween.

With regard to this seventh embodiment, it is noted that multiple variations are possible. For example, as depicted in FIGS. **19** and **20**, tube **714** may include indicators in the form of rib and groove elements, **724** and **726** respectively, which allow a user to more precisely position tube **714**. These indicators may also allow a user to more easily determine visually the stiffness position of shoe **710**. As shown in FIG. **23**, a user may also be able to visually determine the position of tube **714**, by merely determining the position of solid side **720**. In addition, while only shown in the drawings as being of a circular cross section, it is noted that tube **714** may be many different cross sectional shapes. For example, tube **714** may be of any cross sectional shape, as long as enough clearance exists within channel **712** to allow tube **714** to be rotated. In another variation, tube **714** could be situated within a housing (not shown) that is capable of being rotated. This would allow similar varying of stiffness. Finally, it is contemplated to employ a tube **714** which, instead of being rotatable, is easily removed from channel **712**. In such a design, the user would simply remove tube **714**, flip such over and replace in channel **712**. This would preferably accomplish the same goal as the above described rotatable tubes **714**.

Manufacturing of tube **714** may be done in many different fashions. For example, a manufacturer may simply extrude a solid tube structure and thereafter slice the individual slits **716** in the tube. In addition, a manufacture could produce the individual segments **718** and thereafter affix them to a separately manufactured solid side or spine **720**. Clearly, any means of affixing segments **718** to solid side **720** could be utilized in such a method. For example, gluing, cementing or welding could be performed. It is noted that manufacturing of shoe **710**, in accordance with this seventh embodiment, may involve modifying shoe **710** itself to cooperate with tube **714**. For example, in addition to the necessity of a channel **712**, shoe **710** may also require differing elements than the above-described shoe **10**. As shown in FIG. **19**, a sole unit employed in shoe **710** may be of a different design. However, this is not necessary in all shoes manufactured in accordance with this seventh embodiment of the present invention. In addition, multiple tubes **714** may be employed, e.g. on medial or lateral sides of one shoe **10**, permitting variations in stiffness between different portions of the shoe **10**.

While the above embodiments are depicted in the drawings and discussed throughout as providing an adjustable shank **32** which is capable of varying the stiffness of sole unit **11** in a direction extending from the front of the foot (e.g.—toes) to the rear of the foot (e.g.—heal), it is to be understood that the stiffness of sole unit **11** may also be varied in a medial/lateral direction from the outside of the foot to the inside of the foot. Similarly, it is also contemplated to provide a tension adjustment mechanism which operates in this medial/lateral direction to control any adjustable shank **32** discussed herein. Further, it is also envisioned to provide a tension adjustment mechanism which is located at various positions on shoe **10**. For example, although shown in the drawings as being located adjacent a heel section, a tension adjustment mechanism may be located in the forefoot or front section of shoe **10**.

Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

The invention claimed is:

1. An article of footwear comprising:

an upper defining a cavity for receiving a foot;

a sole unit attached to said upper; and

an adjustable shank adapted to adjustably vary stiffness of said sole unit in a section corresponding to a forefoot of a wearer, the adjustable shank including a plurality of segments forming a continuous one-piece structure,

wherein said adjustable shank is a rotatable member permanently contained within said article of footwear, and wherein rotation of the rotatable member varies the stiffness of said sole unit.

2. The article of footwear according to claim **1**, wherein said sole unit includes an outsole and a midsole, and said adjustable shank is located between the outsole and the midsole.

3. The article of footwear according to claim **1**, further comprising an adjustment mechanism coupled to said adjustable shank for adjusting said adjustable shank.

4. The article of footwear according to claim **3**, wherein the adjustment mechanism cooperates with said sole unit.

5. The article of footwear according to claim **1**, wherein the plurality of segments are connected at flex points.

6. The article of footwear according to claim **5**, wherein the flex points are living hinges.

7. The article of footwear according to claim **1**, wherein the plurality of individual segments cooperate with each other to adjustably vary the stiffness of said sole unit.

8. The article of footwear according to claim **1**, wherein the rotatable member is a unitary body having a plurality of slits formed partially through the body.

9. The article of footwear according to claim **8**, wherein the rotatable member is disposed in a channel formed in a portion of said article of footwear.

10. An adjustable shank member for use in an article of footwear, said adjustable shank member comprising:

a plurality of segments forming a continuous one-piece structure; and

an adjustment assembly for adjusting the cooperation between said plurality of segments,

wherein said adjustable shank member is adapted to vary stiffness of a sole unit of said article of footwear in a section corresponding to a forefoot of a wearer, at least a portion of said adjustable shank member is permanently dispose in a channel formed in a section of said article of footwear, and rotation of said adjustable shank member varies the stiffness of said sole unit.

11. The adjustable shank member according to claim **10**, wherein the adjustable shank is a rotatable tube.

12. The adjustable shank member according to claim **11**, wherein the tube has a circular cross section.

13. The adjustable shank member according to claim **11**, wherein the rotatable tube is a unitary body having a plurality of slits formed partially through the body.

14. The adjustable shank member according to claim **13**, wherein the rotatable tube includes at least one solid side.

15. The adjustable shank member according to claim **14**, wherein the adjustment mechanism is connected with and capable of rotating a rotatable tube.

16. The adjustable shank member according to claim **15**, wherein the adjustment mechanism is a dial structure.

17. The adjustable shank member according to claim **10**, wherein said adjustment assembly includes an adjustment mechanism.

18. The adjustable shank member according to claim **10**, wherein said plurality of segments are connected to each other at flex points.

19. The adjustable shank member according to claim **18**, wherein the flex points are living hinges.

20. The article of footwear according to claim **9**, wherein the rotatable member is a tube.

21. The article of footwear according to claim **20**, wherein the tube has a circular cross section.

22. The article of footwear according to claim **8**, wherein the rotatable member includes at least one solid side.

23. The article of footwear according to claim **1**, wherein the rotatable member is connected with an adjustment mechanism capable of rotating the rotatable member.

24. The article of footwear according to claim **23**, wherein the adjustment mechanism is a dial structure.

25. An article of footwear comprising:

an upper defining a cavity for receiving a foot;

a sole unit attached to said upper;

a rotatable member adapted to adjustably vary stiffness of said sole unit in a section corresponding to a forefoot of a wearer upon rotation, said rotatable member including a plurality of segments forming a continuous one-piece structure; and

an adjustment mechanism capable of rotating said rotatable member,

wherein said adjustable shank is permanently contained within said article of footwear.

26. The article of footwear according to claim **25**, wherein said sole unit includes an outsole and a midsole, and said rotatable member is located between the outsole and the midsole.

27. The article of footwear according to claim **26**, wherein said rotatable member is disposed in a channel formed in a portion of said article of footwear.

28. The article of footwear according to claim **25**, wherein said plurality of segments are connected to each other at flex points.

29. The article of footwear according to claim **28**, wherein the flex points are living hinges.

30. The article of footwear according to claim **25**, wherein plurality of segments are separated by a plurality of slits.

31. The article of footwear according to claim **30**, wherein said rotatable member includes at least one solid side.

32. The article of footwear according to claim **25**, wherein said rotatable member is a tube.

33. The article of footwear according to claim **32**, wherein the tube has a circular cross section.

34. The article of footwear according to claim **25**, wherein the adjustment mechanism is a dial structure.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,540,100 B2
APPLICATION NO. : 11/436920
DATED : June 2, 2009
INVENTOR(S) : Christopher J. Pawlus et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2, line 12, “ad the” should read --and the--.
Column 2, line 22, “be couple to” should read --be coupled to--.
Column 2, line 58, “segment” should read --segments--.
Column 3, line 43, “grove joint” should read --groove joint--.
Column 3, line 47, “grove joint” should read --groove joint--.
Column 7, line 7, “34d are preferably” should read --34d is preferably--.
Column 8, line 32, “steel braided cable, but may be may other” should read --steel-braided cable, but may be other--.
Column 8, line 41, “not necessary,” should read --not necessarily,--.
Column 11, line 14, “are preferably” should read --is preferably--.
Column 12, line 52, “484 may” should read --484, may--.
Column 12, line 56, “This clearly, allows” should read --This clearly allows--.
Column 12, line 57, “Stiffening element is” should read --Stiffening element 482 is--.
Column 13, line 41, “like shaped” should read --like-shaped--.
Column 14, line 32, “with 710” should read --with shoe 710--.
Column 16, line 39, “dispose” should read --disposed--.
Column 18, line 10, “claim 25, wherein” should read --claim 25, wherein said--.

Signed and Sealed this

Third Day of August, 2010

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office